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CHEMICAL AGE

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IN THIS ISSUE

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SCIENCE AT BRUSSELS

THE most outstanding impression from a visit to the Brussels World Exhibition is of the great advances made in science and technology throughout the world in the past few years. Nowhere is this better portrayed than in the exhibition's International Hall of Science, which is devoted to pure scientific research.

In this hall, visited last week by those attending the opening of the second congress of the European Federation of Chemical Engineering—a congress that is being continued this week in Frankfurt—the scientists of 14 other nations have co-operated with the Belgians in building up a picture of world progress in four main scientific themes—the atom, the molecule, the crystal and the living cell.

The exhibits in this hall portray the work undertaken in the four main fields—some of it fundamental work dating back to the beginning of the century, but much of it representing new researches now being undertaken in institutes in various parts of the world. There is something in this hall to interest all engaged in chemistry, both organic or inorganic. Most of the exhibits are presented in a stimulating manner, much use being made of films, multilingual recorded descriptions, three-dimensional techniques, novel lighting effects and a high standard of display material.

The benefits of science and technology are shown in many of the other pavilions and halls, in some cases by industrial exhibits and in others in group form—there are Belgian halls relating to electricity, gas, chemical industry and petroleum. Among national stands that strongly emphasis the contribution of science to world living standards are those of the USSR, where the effect is somewhat overwhelming, the UK, Czechoslovakia, France, etc.

But from the visiting chemist's point of view the highlight of the exhibition is the Hall of Science. The exhibits are immensely practical; many show not only chemical, atomic and molecular and cellular structures but examples of reactions are given as well, while the techniques and apparatus of the chemist and physicist are explained, in many cases in great detail. Many visiting chemists have already found much of direct interest in their own work from the exhibits of other countries.

Scientists of many nations are available to expand on the details shown. In this hall, the contributions from Russia, the US, Germany, the UK, Italy and France predominate, with the Russians appearing to dominate. The accent, however, is not on nationalities, for science knows no boundaries, but on positive achievement.

The UK exhibits have been co-ordinated by the Royal Institution under the direction of Sir Lawrence Bragg. In his introduction in the handbook published in conjunction with the Hall of Science, Sir Lawrence says 'What you will see in this hall is the result of pursuing scientific knowledge for its own sake, knowledge which goes as it were into a common store from which the technologist can draw the material he wants for his practical purposes'.

That this is done most effectively is a tribute to the Belgian organisers. Our review of exhibits in this hall appears on page 1027. It is necessarily brief and aims at showing readers the wide diversity of work displayed.

DANGER OF PENTACHLOROPHENOL

THERE are possibilities that pentachlorophenol is more toxic than previously thought. This chemical (Monsanto Penta) or its sodium salt (sodium pentachlorophenate; Santobrite) which are manufactured by Monsanto Chemicals Ltd., is best known for its use as a wood preservative. The sodium salt is readily soluble in water, stable, practically odourless, non-corrosive to metals, and toxic to a very wide range of micro-organisms, including fungi, yeasts and bacteria. Uses in industry include as a preservative, fungicide and disinfectant. Pentachlorophenol is not a scheduled poison and has until recently been considered relatively non-toxic.

In Sarawak Santobrite is used to prevent sap-stain in timber. For this purpose it is used as a solution of between 1½ and 2 per cent in water, and occasionally, anhydrous sodium carbonate or borax is added to prevent 'acidic' timbers causing precipitation of the pentachlorophenol with subsequent deterioration of its preservative powers.

Two methods are in use for preserving timber in this chemical; a mechanical method whereby wood is carried by an endless chain; and hand-dipping where the wood is removed by hand or a wire hook.

Within a period of 18 months, nine deaths have occurred among workers in saw mills in Sarawak, where Monsanto Penta or Santobrite is used for preserving timber. Reporting these cases in the *British Medical Journal* (1958, **i**, 1156) Dr. J. A. Menon, Division Medical Officer, Third Division, Sarawak, states that the most striking fact is the rapidity of the illness, death ensuing within nine hours (in six cases) and within 16 hours in two. The third case died after 25 hours after strenuous efforts to combat hyperpyrexia and dehydration.

Symptoms which have been noted are hyperpyrexia, gross dyspnoea, and prolific sweating. Abdominal symptoms have been recorded also. Terminal spasm was present in the nine cases which were investigated by Dr. Menon.

Treatment of pentachlorophenol poisoning is stated to be very unsatisfactory and is largely symptomatic, the main points being to combat the hyperpyrexia, to replace the electrolytes, and to add glucose to replace the carbohydrate destroyed by pentachlorophenol's raising of the basal metabolic rate. Cortisone and chlorpromazine are considered to be worth a trial.

The only answer, at present, according to Dr. Menon, is preventive measures but these will be difficult to apply rigorously when dealing with native peoples. The problem of pentachlorophenol toxicity with fatal results is magnified in tropical countries. There are also indications of extra susceptibility on the part of some races.

Monsanto Chemicals list the hazards of pentachlorophenol as being confined to irritation of the mucous membranes, sneezing, and contact dermatitis of exposed areas of skin, but other observers have reported toxic effects such as peripheral neuritis, mucosal irritation of the upper respiratory tract and acne.

It has been suggested by Dr. E. F. Edson in a personal communication to Dr. Menon that pentachlorophenol, like dinitrophenol and dinitrocresol, causes a radical uncoupling of oxidation and phosphorylation cycles in the tissues, thus producing a marked increase in basal metabolic rate with all the effects of heat accumulation.

From the evidence available there is a serious danger if pentachlorophenol is handled carelessly. The danger of toxicity appears to be enhanced in very hot weather and for persons living on restricted or poor diet. Avoidance of contamination of hands, clothing and food is important. Also since the chemical is used in preparations for treating woodworm, possibly a cautionary note should be placed on containers.

HELIUM RECOVERY PROCESS

FROM Bell Telephone Laboratories, US, comes news of a process to separate helium from natural gas by diffusion through the walls of fine glass tubes. This company believes that a potential 10 million cubic feet of helium, now wasted every day, could be recovered using this process.

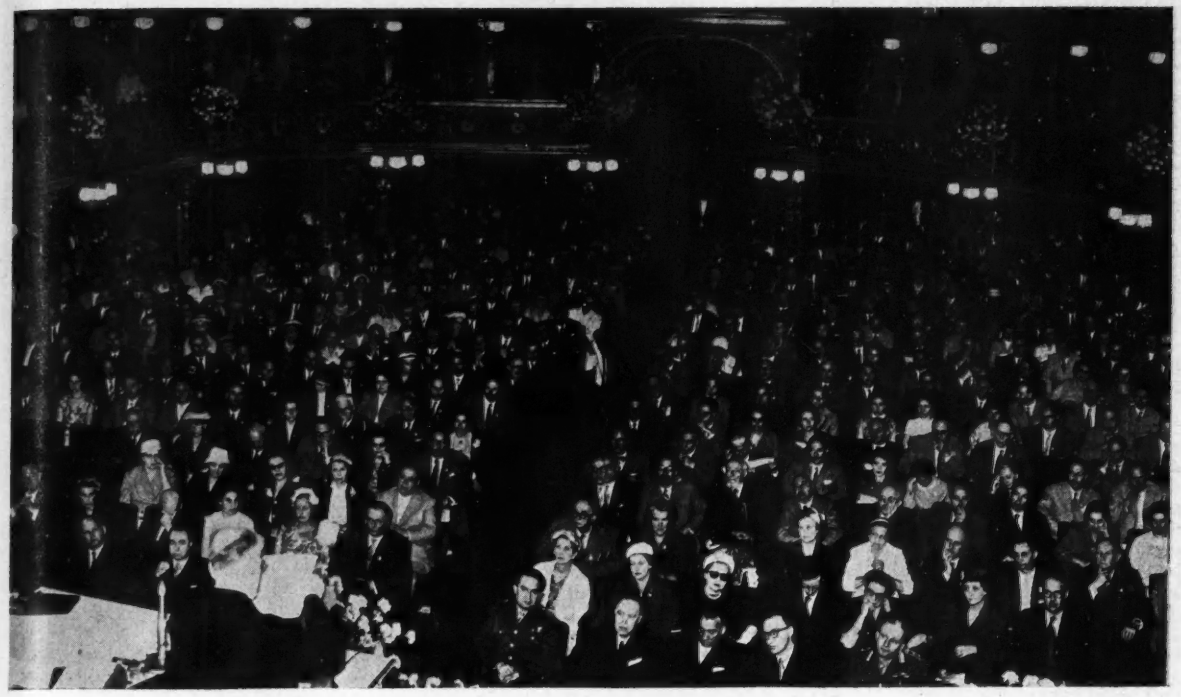
To separate the helium the gas is passed through a chamber a few cubic inches in size, packed with fine silica glass tubing (30 to 40 ml. outside diameter, 3 to 5 ml. wall thickness) which is described as having high compressive strength. Since the helium atoms are only 2.0 A in diameter, they diffuse through the walls of the tubing. Hydrogen molecules have a diffusion constant a thousandth as large, and as methane molecules have diameters of 9.5 to 5 A and very small diffusion constants they pass through glass at a negligible rate at normal temperatures. (Experiments by Bell have been carried out at up to 700°F to 800°F and 1,000 atmospheres.) Some 30 l. of helium a day have been purified in the chamber described above.

Particular attention has been paid to experiments conducted at 500 p.s.i., as this is the pressure for transcontinental transmission of natural gas. From the results they have so far achieved the Bell researchers calculate that a chamber of 2 cubic yards could purify 100,000 cubic feet of helium a day at room temperature and 1,000 atmospheres. Most of the work has been carried out using pure helium and 'synthetic' mixtures, but some experiments have been conducted using natural gas available in the New York area. These latter have shown that no gases besides helium, hydrogen and neon pass through glass at room temperature.

Helium rich gas contains something less than 1 per cent of helium. The method used to recover the gas is low temperature distillation by which means a million cubic feet of helium are recovered. However, some 10 million cubic feet are lost to the atmosphere when natural gas is burned for fuel.

In the US demand for helium has exceeded the amount of gas recoverable at the four Bureau of Mines plants (292 million cubic feet in 1957, five times the 1949 level). The possibilities are being considered, therefore, of building a recovery plant on a pipeline serving several areas producing helium-bearing gas, of lower helium content than is considered worth while recovering. Results obtained using the Bell process indicate that the process can be adapted to separating helium even at low concentrations existing in natural gas.

The US Department of the Interior is proposing that 12 helium-recovery plants should be built near the natural gas fields. The Department estimates that 32 million cubic feet of helium can be recovered and the US Government is now discussing with private industry ways and means of getting the project under way. The cost is estimated at about $224 million. If private industry does not wish to build the plants, the Government intends to build and operate them. The recovery method to be used is still open to discussion. Possible approaches are considered to be low temperature fractionation or the new Bell Laboratories' process described above.



Inaugural session in the Teatro Carignano, Turin

JOINT MEETING IN TURIN

SCI Join Italian Chemists for Annual Congress

UNDER the patronage of the President of the Italian Republic, Giovanni Gronchi, and HM Queen Elizabeth II, the eighth National Congress of the Società Chimica Italiana was held jointly with the Society of Chemical Industry in Turin, Italy, last week from 26 May to 2 June.

The inaugural session, held in the Teatro Carignano, Turin, was opened by the Mayor of Turin, Dr. A. Peyron. In his speech of welcome, he said he hoped that the various papers and discussion would prove of very real interest. The president of the Società Chimica Italiana, Professor Mario Cingolani, then addressed the delegates.

Mr. H. Greville Smith, SCI president, said it was a privilege and pleasure to join with Professor Cingolani in welcoming delegates to the Congress. He said it was a historic occasion in that it was the first time that there had been an Italo-British congress of the chemical societies.

Mr. Smith said he wished to pay tribute to Professor D. Marotta, director of the Istituto Superiore di Sanità, Rome, for the interest he had given to this project, and to a member of his staff, Professor Chain, whose valuable efforts he felt were responsible for the congress. On behalf of the SCI, Mr. Smith extended congratulations to those presenting papers.

Representing the Italian Government at the opening session was the Minister for Foreign Affairs and Vice-President of the Cabinet, the Hon. Professor Guiseppe Pella.

Hon. membership of the Società Chimica Italiana was then conferred on Sir Charles Dodds, Courtaulds Professor of Biochemistry, London University, Sir Harry Melville, secretary, DSIR, Professor Ezrah B. Chain (of the Istituto Superiore di Sanità, Rome). The gold medals of the Società were presented by the Italian Minister for Foreign Affairs.

The Stanislao Cannizzaro Medal was presented to Professor Arturi I. Virtanen (Nobel Laureate, 1945), president of the State Academy of Science and Arts of Finland. Sir Alexander Todd, Nobel Laureate, professor of organic chemistry, Cambridge University, received the Emanuele Paternò Medal and Sir William Ogg, director of the Rothamsted Experimental Station, the Raffaele Piria Medal.

A number of papers are summarised below, others will be reported next week.

Chemists Hold Key to Nuclear Development, says Cockcroft

KEY to the development of nuclear energy lies in the work of the chemists, stated Sir John Cockcroft in his paper on 'Nuclear energy', which he gave after the opening of the congress. He was introduced by Sir Ben Lockspeiser, who was in the chair and who reminded congress members that in the nuclear field the distinction between chemist and physicist was becoming difficult to define.

Sir John outlined progress in the UK programme for the application of nuclear energy to the production of electricity. He also gave details of experiences with Calder Hall, including the behaviour of fuel elements (see CHEMICAL AGE, 24 May, p. 949).

Dealing with the role of the chemist, he said that, while the radiation chemist had played an important part in the study of the graphite oxidation problems and the analytical chemist was vitally concerned with the achievement of high purities in graphite and uranium metal, the main role of the chemist, in the future would be in the conversion of uranium ore to metal and in the chemical processing of spent fuel elements. The UK Atomic Energy Authority would soon complete construction of a major new plant for converting ore into metal fuel elements.

The chemical processes for this purpose had been drastically changed. Thus a fluidised bed process was being introduced for the production of UF_4 which would then be reduced by magnesium. Extension

On the platform at the inaugural session, l. to r., Sir William Ogg, director, Rothamsted Experimental Station, Sir Ben Lockspeiser, former DSIR secretary, Mayor of Turin, H. Greville Smith, SCI president, and Professor Daniele Bovet

of chemical processing facilities at Windscale was also planned, for the AEA were intending to process fuel elements supplied to electricity organisations abroad using a British reactor design. The cost of transport from Italy of fuel elements in lead-walled cylinders would only be a small fraction of the value of the spent fuel elements, remarked Sir John.

At the end of their useful life when the heat equivalent of 10,000 tons of coal had been extracted, each ton of uranium fuel would contain a little over 2 kg. of plutonium. The electricity authorities are to be given a credit of about £5,000 per ton of spent uranium fuel. The plutonium could be recycled through the reactor together with some of the depleted uranium. Using this method, the feed of virgin uranium could probably be reduced about three times, so justifying the credit for the spent fuel elements. Or the plutonium could be used as fuel for propulsion reactors.

The interest of the chemist was not confined to the separation of plutonium and fission products in the chemical separation plant. Windscale chemists were preparing to extract from the fission products, useful components such as caesium 137 and strontium 90. A pilot plant in operation for two years had produced a number of kilocurie sources of radio-caesium for radiotherapy. The Wantage Radiation Laboratory already equipped with 10,000 curie sources of radio cobalt was shortly to have sources of several hundred thousand curies of Co 60 available. For large-scale applications such as co-polymerisation, stimulation of halogenation reactions, etc., UKAEA expect to produce by 1960, over a million curies a year of radio-caesium.

Another important product separated from fission products was Krypton 85. With its half-life of 10 years Krypton could be used to produce low intensity light sources such as runway markers, buoys and marine lights. The gas has been incorporated into organic compounds and mixed with activated zinc sulphide phosphor and polyethylene powder. A one-curie Krypton source has proved to be visible ½ to 1 mile in the dark.

Ending this lecture, which was illustrated throughout by short coloured films and by slides, Sir John discussed ZETA and its possibilities.

Stereospecific Polymerisations and Catalysis Reviewed by Natta

AT the first plenary session on 27 May of the VIII National Congress of the Societa Chimica Italiana held jointly with the SCI in Turin, Professor Giulio Natta, director of the Polytechnic Institute of Industrial Chemistry, Milan, reviewed stereospecific polymerisations and catalysis.

Discussing the behavour of the different monomers in the stereospecific catalysis processes, Natta said that with the use of complexes containing transition metals, electropositivity of which is reduced with regard to the typical Ziegler catalysts, polymerisation of monomers containing electron attracting groups (vinyl ethers, vinyl chloride, etc.) is possible. He and his co-workers have obtained with some complexes containing transition metals, aluminium and halogen atoms, high yields of polymers of vinyl-alkyl-ethers, having high molecular weight and higher crystallinity than the polymers obtained by Schildknecht with catalysts consisting of boron fluoride-etherates (*Ind. Eng. Chem.* 1958, **50** 107).

The properties of the random copolymers of alpha-olefins present some analogies with those of stereoblock homopolymers. Small quantities of a different monomer introduced into an isotactic polymer reduce its crystallinity and lower the melting point, as occurs with the presence of sterically different units in stereoblock homopolymers. Higher quantities (e.g. higher than 20 per cent) make the copolymers amorphous.

Compared with the products obtained using typical Ziegler catalysts, the products obtained by continuous polymerisation, either with certain catalysts containing only one type of highly stereospecific active centre, or with certain non-stereospecific catalysts (e.g. obtained from VCl and trihexyl aluminium) are constituted only of copolymers and are free of homopolymers. Natta *et al* have demonstrated these findings by accurate fractionations of the copolymerisation products and examining the properties of the different fractions (*Chimica Industria* 1957, 39, 733, 743, 825).

The mechanical properties of the copolymers prepared by Natta, *et al.* are different from those of the homopolymers and from those of their physical mixtures. Amorphous copolymers Natta suggests, can be used as raw materials for the production of good elastomers.

Non-vulcanised polymers show a viscoelastic behaviour which is very similar to the polyhydrocarbons having a low second order transition temperature, reports the professor. They show low initial elastic moduli and high ultimate elongations. The temperatures at which the resilience decreases, reaching a minimum, is near that shown by natural rubber.

Cross-linking of the ethylene-propylene copolymers can be suitably achieved by

Professor G. Natta delivering his paper at the Istituto Chimica

different methods and leads to vulcanised products having excellent chemical resistance, high tensile strength and good elastic properties (work to be published shortly). They can be reinforced with active fillers (such as carbon-black and silica) or mixed with conventional plasticisers. A 50 per cent propylene—50 per cent ethylene copolymer having an intrinsic viscosity about 4 reinforced with 45 parts of carbon-black, shows, after vulcanisation, tensile strengths of 300-400 Kg/cm², ultimate elongations of 500-600 per cent, a hardness of 60-70 degrees (Shore A), and a rebound, at room temperature, of 60 to 70 per cent.

In comparison with other elastomers, the ethylene-propylene copolymers, being constituted by substantially saturated macromolecules, have a high resistance to oxidation and ageing; also, they resist fairly well attack by a variety of chemicals, such as sulphuric acid, nitric acid etc.

A comparison of the properties of the trans 1-4 and cis 1-4 butadiene stereoisomers, which differ from each much more than the corresponding isoprene 1-4 stereoisomers, has proved very inter-

esting, Professor Natta reports. Trans 1-4 polybutadiene, which can be obtained in a state of very high purity with catalysts prepared from VCl_3 and aluminium alkyls, has a melting temperature of about 140°C, and a first order transition due to polymorphism at 65°C (Natta, Porri, Corradini and Morero, *Chimica Industria*, in press.)

When the stereoisomeric purity decreases, the melting temperature decreases to values lower than 100°C, and the other transition temperatures reach values which are lower than 65°C. The trans 1-4 polybutadiene when extruded into filaments can be cold-stretched. The highly crystalline and oriented filaments thus obtained present properties which are similar to those of the muscles. In fact, Professor Natta reports that the reversible transformation of the crystals in other equally oriented crystals is accompanied by contraction in the length of the filaments when heated at 65°C.

Professor Natta states that cis 1-4 polybutadiene with a steric purity of 95 to 97 per cent has a melting point temperature of about 0°C; it crystallises under stretch (400 per cent) and is still crystalline at a temperature of 70° to 80°C. It shows properties which are very similar to those of natural rubber. Less pure polymers melt at lower temperatures. The variations of elastic properties as functions of the stereoisomeric purity prove very interesting, Natta reports. The different mechanical behaviour and the high tensile strength are due to the higher stereoisomeric purity which allows a higher crystallinity under stretching and a higher melting point.

New Polymers

In a consideration of new plastics, Professor Natta remarks that from the practical point of view, the most interesting polymers are the highly crystalline polypropylene (m. pt. 175°C) and poly-1-butene (m. pt. 136° to 140°C) because of the low cost of the monomers, immense amounts of which are available in petroleum cracking gases.

Certain linear isotactic and low crystalline stereoblock polymers having high molecular weight are of particular interest, owing to their higher elasticity compared with that of the highly crystalline polymers. They consist of macromolecules containing isotactic chain sections interspersed with atactic sections or with isotactic sections of opposite steric configuration, and offer properties which can be varied gradually, depending on their stereoisomeric composition, from the properties of a hard, highly crystalline thermoplastic material, having a high tenacity, to less crystalline materials, having mechanical properties similar to those of leather, etc., to still more elastic rubber-like materials.

In a consideration of new fibres, Professor Natta indicated that the low cost of propylene, the high yield and the ease of the low pressure polymerisation, the direct obtainment by polymerisation of a highly crystalline material which, without any fractionation, gives directly by dry extrusion filaments with a low count and a high strength, make possible the production on a commercial scale of textile fibres, the production cost of which is likely to become lower than that of any other synthetic textile fibre.

The great lightness of the polymer and the possibility of obtaining very soft staple fibres with high thermal insulating properties, but having a much greater mechanical strength than wool, open up wide possibilities of use.

According to Professor Natta the diolefin polymers with cis 1-4 enchainment may give rise to rubbers having very good elastic properties. At the Polytechnic of Milan, polybutadiene stereoisomers with cis 1-4 enchainment which crystallise under stretch, as does natural rubber, have been prepared; and at the Donegani Research Institute of Novara, successive products of high stereoisomeric purity have been obtained. These polymers are reported by Natta to yield elastomers which show excellent elastic properties at very low temperatures and high tensile strength. The lower cost of butadiene in comparison with the cost of isoprene suggests great possibilities for this new polymer. Natta also believes that there is a great future for an entirely new class of synthetic elastomers, the ethylene-propylene copolymers. Rubbers prepared from these copolymers show resilience values which approach those shown by natural rubber, a very high tensile strength and high elastic elongations. Again Natta considers the very low cost of these olefins from petroleum makes this new class of elastomers of remarkable interest in the production of synthetic rubbers.

POTENTIAL PHOSPHORYLATING PROCEDURE OUTLINED

by Alexander Todd

QUITE extensive studies on phosphorylation have been necessary in Sir Alexander Todd's work on nucleotides and on nucleotide coenzyme synthesis. These studies have in fact led to the development of a number of new methods for the phosphorylation of alcohols and phenols, and for the related preparation of pyrophosphates and triphosphates, and in some instances, to a clearer understanding of the behaviour of phosphate esters which may be of significance in connection with their role in nature.

In his paper on 'Some aspects of phosphorylation', given at the first plenary session of the congress, Sir Alexander said that the so-called exchange reaction of pyrophosphates or mixed anhydrides of phosphoric and other acids with phosphate ions was of great importance in the synthesis of pyrophosphates and polyphosphates, in the laboratory and in nature.

A striking fact was that in biological systems, mono-esters of pyrophosphoric and triphosphoric acid were used to carry out phosphate-transfer reactions analogous to those which can be effected in the laboratory only when fully esterified polyphosphates were employed. Specific examples were provided by phosphate transfer using adenosine triphosphate, as well as by the enzyme synthesis of flavin-adenine—dinucleotide from adenosine triphosphate and riboflavin-5′ phosphate.

This suggested that one function of the enzyme protein in these biological systems was to exert an effect on the polyphosphates comparable in its effect to esterification. One possibility had been that the effect was achieved by strong hydrogen-bonding which suppressed dissociation of the free acid groups and facilitated attack on phosphorus by nucleophilic reagents.

In a series of experiments Dr. F. Cramer, in Cambridge and Heidelberg, has investigated the validity of this view by studying the effect of cyclodextrins on the rate of hydrolysis of partly esterified polyphosphoric acids. Todd and Cramer have shown that nucleoside pyrophosphates and triphosphates form inclusion compounds with α- and β-cyclodextrin when the latter were added to their aqueous solutions. Although the apparent pH of the solution was not affected by addition of the cyclodextrin, there was a very marked increase in the rate of hydrolysis of adenosine-5′-pyrophosphate and of P′P_2-diphenyl pyrophosphate.

This was interpreted by assuming that inclusion of the pyrophosphate was equivalent to removing it from the aqueous medium to one in which there was a strong hydrogen-bonding. If this view was correct, it offered an interesting approach to the problem of the mechanism of action of those enzyme systems involved in phosphate transfer and perhaps to that of other enzyme systems also. It suggested that part,

L. to r. Dr. R. Wiechert (Schering AG, Berlin), Mr. F. E. Sale and Mr. K. H. C. Bessant (both of research station Distillers Co. Ltd.)

Professor Sir Alexander Todd receives a medal from the Italian Foreign Minister. In the background is Professor Cingolani, president, Societa Chimica Italiana

at least, of the function of the enzyme protein was to stabilise the polyphosphate by a process of hydrogen-bonding similar to that mentioned above, and helped to explain substrate specificity.

The magnitude of hydrogen-bonding produced by the protein could well be determined, e.g. a nucleoside pyrophosphate would transfer phosphate to a substance A and leave another substance B unaffected. Equally, the effect might be exerted on either of the acids making up the pyrophosphate so that in the case of a nucleoside pyrophosphate different enzyme proteins might produce either transfer of phosphate or of the nucleotide residue. Experimental work was now in progress to test the validity of these views, stated Sir Alexander.

Hydroxyl Groups

During investigations it had been found necessary to seek other methods to obviate or greatly reduce the need for protection of hydroxyl groups in intermediates used in polypeptide synthesis. The first method investigated was that using dialkyl or diaryl carbo-imides (RN = C = NR) as reagents. These substances reacted very rapidly at room temperature with mono- and di-esters of phosphoric acid to give respectively di- and tetra-esters of pyrophosphoric acid. Similar but less reactive in producing pyrophosphates, were ketenimines and cyanamide derivatives.

Dimethyl cyanamide had proved a very effective general purpose reagent as it was much less readily hydrolysed by water than di-cyclohexyl and carbodi-imide and dialkyl pyrophosphates were formed in high yield without appreciable hydrolysis of the reagent. The carbodi-imide method had also been used to prepare mono-esters such as nucleoside pyrophosphates and triphosphates by carrying out the reaction between nucleotide and phosphoric acid in presence of a large excess of the latter.

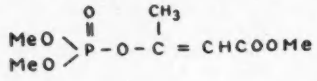
This method, although ideal for the preparation of symmetrical esters, was much less suitable for unsymmetrical esters, since the reaction of a carbodi-imide with a mixture of two different phosphoric acids usually produced an approximately statistical mixture of all three possible pyrophosphates which might be difficult to separate from each other. Exceptions to this were found, however, where one of the reacting phosphates has a dipolar-ionic character.

It was of interest to note, stated Sir Alexander, that the actual phosphorylation process involved in the carbodi-imide (or imidoyl phosphate) reaction differed, at least superficially, from phosphorylation using phosphoric anhydrides.

The phosphor amidate method of polyphosphate synthesis was attractive for use in nucleotide chemistry, as it left hydroxyl groups unaffected; protection of sugar hydroxyls was therefore unnecessary.

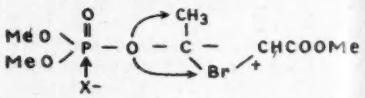
That addition of a proton to nitrogen in the ψ-urea phosphates, imidoyl phosphates and phosphoramidates yielded phosphorylating agents, suggesting that in other types of phosphate derivatives a similar generation of a phosphorylating agent might be achieved by withdrawal of electrons from groups near the phosphorus atom, i.e. by oxidative processes. This had recently been established in Cambridge and two new potential methods of phosphorylation had emerged. It was too early to assess their value in preparative work, but results so far obtained were of considerable general interest. One involved enol phosphates and the other quinol phosphates.

Interest in enol phosphates had been further stimulated by the properties of a recently introduced systemic insecticide 3-(0,0-dimethylphosphoryloxy)-but-2-enoate (Phosdrin-Shell) a mixture of cis and trans isomers. This material showed



low activity *in vitro* as an anti-esterase and was relatively resistant to hydrolysis, but it was highly toxic *in vivo*. This type of behaviour was no doubt due in many cases to conversion of the insecticide *in vivo* into a powerful phosphorylating agent, which was then capable of reacting with essential enzyme systems.

This activation process appeared to involve oxidation in, e.g. the case of octamethyl pyrophosphoramide (Schradan) and at pH 9.5 addition of sodium hypobromite caused almost instantaneous liberation of dimethyl phosphate from Phosdrin; a similar but less dramatic effect was produced by pertungstic acid. This could be interpreted as a process which could be pictured thus:



in which the attack on X^- on the phosphorus atom was facilitated by the attack of Br^+ on the olefinic double bond; i.e. attack of the oxidising agent generated a phosphorylating agent. It had not yet been established whether an oxidative process was responsible for the activation of Phosdrin *in vivo* but this seemed probable. Biological experiments designed to test this hypothesis are under way. This remarkable effect of oxidising agents on enol phosphates offered a potential phosphorylation procedure.

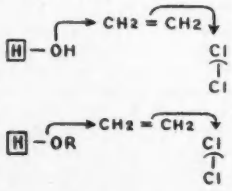
Even more striking was the behaviour of the quinol phosphates. Addition of bromine water or of a ceric salt caused instantaneous production of ortho-phosphate and the corresponding quinone (unpublished results). Particularly interesting, remarked Sir Alexander, was the observation that addition of bromine water to an aqueous solution of the diphosphate of 2-methyl-1:4-dihydroxy-naphthalene caused immediate precipitation of 2-methyl-1:4-naphthaquinone and production of some pyrophosphate. The scope and value of these observations in the general field of laboratory phosphorylation were being explored. From the biological standpoint they were of wider interest, however, for not only had the quinol phosphate work a possible bearing on the mode of action of vitamin K, but the coupling of oxidation with phosphorylation as a necessary step with quinol phosphates and enol phosphates opened up new avenues of approach to the important problem of oxidative phosphorylation in biological processes.

CHEMICAL TRANSFORMATIONS OF LOWER OLEFINS AND DERIVATIVES

THE mechanism of a few of the typical reactions of the olefins which were specially significant in this field were considered from the point of view of the organic chemist, that was by attempted generalisation, by Sir Robert Robinson. The more important of the systems including conjugated displacements were mentioned. Sir Robert's paper, given in the second plenary session, was entitled 'Chemical transformations of the lower olefins and their derivatives'.

In a consideration of examples of olefin reactions of industrial importance Sir Robert dealt with (1) direct epoxidation of ethylene. This occurred at the surface of a supported silver catalyst and might be considered as a simple attack of an oxygen atom in loose combination followed by separation from the silver and cyclisation. Other and more complex mechanisms might be contemplated but all would have the common feature of the anionoid, oxidisable, ethylene molecule.

In formation of ethylene chlorhydrin the reactants were ethylene, water and chlorine. The process was often represented as $Cl_2 + H_2O \rightarrow HOCl$ followed by addition of the hypochlorous acid to the hydrocarbon. Sir Robert suggested a different scheme, namely, attack of the ethylene by a chlorine molecule and participation of the water as follows.



If in place of the water, an alcohol, R.OH was used, the outcome was the formation of $R.OCH_2CH_2Cl$ and by the use of appropriate salts, NaX, it was possible to obtain $X.CH_2CH_2Cl$. As $Cl.CH_2CH_2OH$ accumulated in the usual process, its concentration became high enough to enable the substance to participate. This produced the by-product Cl. $CH_2CH_2OCH_2CH_2Cl$.

The view that ClOH was the effective reagent demanded the use of a whole series of esters. R.OCl was inherently improbable in view of the fact that Cl_2 was about 1,000 times as active as ClOH towards the phenoxide ion, stated Sir Robert. However, the predominant role of a chlorine molecule had been confirmed by kinetic measurement.

Various syntheses of Friedel-Crafts type were usually interpreted ionically on the side of the catalyst. They all involved anionoid olefine.

The Ziegler complex of reactions was discussed by Sir Robert with regard to (a) preparation of the alkylaluminiums and (b) the dimerisation reaction (c) polyethylene and polypropylene.

Promotion of the polymerisation process, for example by $TiCl_3$, had been variously interpreted and it could not be said that any real agreement among the theorists had been secured. Sir Robert stated that it was evident that some kind of AlTi complex was operative and it was very likely that activation of the olefine on the solid surface of the heterogeneous catalyst had some part in the result. Sir Robert recalled in this connection the experience of Norrish that ethylene did not combine with chlorine in a paraffin-coated vessel, but did so on a glass surface, and very rapidly on solid calcium chloride.

Main Function of $TiCl_3$

The main function of the $TiCl_3$ was probably exercised by its impaired electron which could plausibly be postulated to function in weakening the Al-C bond, suggested Sir Robert. The electron of $TiCl_3$ acted as a go-between in relay stages, not capable of exact specification. In his view, the olefine, anionoid in character, attacked the Al atom in the first place. There followed migration of the chain to the centre of electron defect. Only the order of the phenomena differed from the conception of Professor Natta and his collaborators. They had found that the reactivity of ethylene was very much greater than that of propylene. The process was characterised as ionic and specifically ionic on the part of the catalyst. This was thought to be in agreement with the known greater aninoid potential of propylene as compared with ethylene, in its turn due to the general effect of the methyl group: $CH_3 \rightarrow CHCH_2 =$. Sir Robert admitted that this was a cogent argument, but he preferred to attribute the relatively lower activity of propylene (compared with ethylene) to a steric consideration. It should be much more difficult, he suggested, to interpolate the C_3 than the C_2 group in the chain in the manner already suggested.

Natta's researches had demonstrated the importance, practical as well as theoretical, of the ordered build-up of chains capable of specific stereo-distribution. His atactic polymers were evidently the result of asymmetric synthesis and this could only be effected at the point of entry of the α-olefine molecule. The part played by the $TiCl_3$ crystal surface in this case had proved to be important. The asymmetric initiative could not be provided by the symmetrical surface. It must originate and be propagated from the asymmetric molecular group first synthesised, stated Sir Robert. 'This could be, and probably is, the first isohexyl group', although it should be remembered that the Al-Ti complex itself could exhibit enantiomorphism under suitable circumstances.

The oxo-synthesis was noteworthy and was typified by one of the earlier examples developed by Roehm and Ruhrchemie AG. Ethylene, carbon monoxide and hydrogen in the presence of a cobalt (carbonyl) catalyst afforded propionaldehyde in good yield and at 100°–150°C/100 Atm. The reaction succeeded in the vapour phase, in the presence of organic solvents, or even in the presence of water. The effective catalyst was possibly cobalt hydrocarbonyl ($Co[CO]_4H$).

The work of Wender, Orchin and collaborators had shown that hydrocarbonylation of α-olefines proceeded with ease at room temperature and ordinary pressure, also without added hydrogen. A most significant result of Wender *et al.* was the discovery that benzyl alcohol and its nuclear substituted derivatives undergo the hydroformylation reaction, using cobalt hydrocarbonyl. The reaction was facilitated by nuclear substituents which released electrons. This reduced the reaction to its simplest terms and as the catalyst was both formylating and hydrogenating, Sir Robert said he preferred a representation using hydrogen atoms and single electron transfers. A carbonium ion mechanism was favoured by many chemists but this did not accord well with the hydrogenating function of the catalyst. Alkylation of saturated hydrocarbons by means of olefins was a very important method of up-grading gasolines and depended on the increase of octave rating accompanying isomerisation to a more highly branched hydrocarbon. In practice, simpler olefines were condensed with *iso*butane or similar hydrocarbons and the catalysts were all acids or Lewis acids, the latter promoted by hydrogen halides ($AlCl_3$, BF_3, H_2SO_4 and HF). Rearrangements were characteristic of the process which was usually considered to proceed by a carbonium ion mechanism with hydrogen transfer.

As an example Sir Robert gave the alkylation of isobutane by propylene using HF as catalyst. This was supposed to go through the stages:

$CH_3CH=CH_2 + HF \rightarrow CH_3CH.CH_3FN^-$

The carbonium ion abstracted H^- from isobutane yielding propane and Me_3C^+ which reacted with propylene to form $Me_3C.CH_2CHMe$. Migration of Me^- afforded $Me_2\overset{+}{C}.CH_2CHMe_2$ which abstracted H^- from isobutane, thus enabling the cycle to be completed and started again. Migration of H^- afforded $Me_3\overset{+}{C}.CH.CH_2Me$ and this was followed by migration of Me^- to $Me_2C\text{-}CHMe.CH_2Me$.

This latter ion could steal H^- from isobutane completing the cycle in a different manner. This ingenious scheme, said Sir Robert, illustrated the fact that 2:4-dimethyl pentane and 2:3-dimethyl pentane were the chief products of the synthesis. All the manifold transformations in this region of chemistry could 'obviously be explained by carbonium ion formation and migration or by any equivalent hypothesis'.

Of various transformations of the simple olefines, Sir Robert said this was beyond the scope of a single lecture. He showed slides illustrating the ramifications of the industrially important reactions and processes.

Sir Ben and Lady Lockspeiser chatting with Dr. David Trail (research director, ICI Nobel Division)

★In the past two weeks, CHEMICAL AGE editorial staff have travelled far to cover the news. One of my colleagues has been to Brussels for the opening of the second congress of the European Federation of Chemical Engineering and to see the Brussels World Fair. Another went last week to Turin to report the joint meeting between the Society of Chemical Industry and the Societa Chimica Italiana. This week a CHEMICAL AGE staff reporter is in Frankfurt for the main part of the chemical engineering congress and the ACHEMA exhibition; these two events being among the most important in the international chemical calendar.

From Turin I hear of a most successful meeting with a number of good stimulating papers. From Brussels, enthusiasm for an exhibition full of exciting ideas and much of interest for the chemist, but disappointment at the handling of the congress arrangements. This latter complaint is heard all too often where international conferences are concerned, but I gather it did not apply so far as the Frankfurt part of the congress is concerned or to the Turin congress.

At any rate Brussels provided one interesting idea of what is expected of the chemical engineer (see p. 1029). This adds up to a multi-linguist, a chemist, a first class administrator with a bent for economy, an enterprising individual gifted with common sense, tenacity of purpose, well educated, cultured and even-tempered. He is expected to be well versed in physics, thermodynamics, kinetics, electricity, electronics, mechanics, etc. And worth every penny of £5,000 a year!

★When Price's (Bromborough) began business in 1812 tallow was considered a simple substance. It was not until 1823 that the French chemist Chevreul showed that it consisted of an oily solid, chemically combined with a substance that did not burn easily and which was later called glycerine. Chevreul also found that the oily solid could be resolved into a liquid portion (oleine) and a solid crystalline portion (stearine).

Since the hard stearine made a much better candle than tallow, Price's perforce became extractors of fatty acids, although at the start they were not particularly efficient at marketing because they concentrated on the stearine and threw away the oleine and glycerine! In 1842, the firm patented a method of distillation in steam which produced a white and almost odourless stearine and at the same time a much purer oleine suitable for lubricating the fibres in wool manufacture. Eventually oleine became the most widely used lubricant for textile fibres, its prime use today.

This background to Europe's largest fatty acid plant is given in *Inco-Mond Magazine*, 6. It is claimed that more than 200 products sold in 40 countries rely on Price's and that 70 per cent of the Bromborough output enters into UK exports, directly or indirectly.

★People who would never expect an untreated cotton dress to keep out the rain or untreated iron to resist rust, may yet complain that *all* plastics are useless if they hear of the failure of one plastics article. They tend to forget the particular product in question was perhaps designed for another purpose entirely, or might have been an early experiment in the field.

At a conference on the new British Plastics Federation specification concerning high density polyethylene tube for cold water services, Mr. D. Sullivan of Copper and Alloys Ltd., talked of the 'bad publicity' which plastics received on occasions. The federation is most anxious to protect both consumer and manufacture from any such misunderstandings and treated the matter of this latest specification as urgent. In fact the specification (see p. 1030), anticipates a British Standard on the same subject.

High density polyethylene tubing can be used satisfactorily with a thinner wall than is possible with the low density material, but there is a danger that one or two inadequate products may come on to the market. The new specification should help to overcome this difficulty. At present the high density material had not been recommended for use in hot water systems because it is possible that high temperatures would cause enough oxidation to reduce tensile strength.

★Improvisation is second nature to most chemists and the results of their ingenuity often lead to techniques that become more widely adopted. This must be true of the staff at the ICI Akers Research Laboratories who in 1952 first used a specially adapted Hoover washing machine for the cultivation of moulds by submerged culture. Penicillin and gibberellic acid are now being produced in a battery of 18 washing machines.

The problem that led to their use was the need to stir constantly and aerate the solution in which the moulds are grown. In their adapted form an inlet pipe is connected to the normal drainage outlet of the machine; a special lid with five holes has also been fixed. Two of these provide for the circulation of water to a small heat exchanger immersed in the solution in the washing machine tub to maintain constant temperature. The third hole is for filling the tub with a solution of sugar, ammonium nitrate, phosphates and other materials on which the mould is grown. The fourth allows samples to be taken during the experiment and the fifth carries a glass pipe down to a bucket as an exit and to take off any overflow of 'froth.' Before use, each machine is sterilised.

★Mr. Alan Walsh, who with his colleagues at the chemical physics section of the Australian Commonwealth Scientific and Industrial Research Organisation's division of industrial chemistry, has been responsible for two major advances in the field of spectroscopy, has deservedly been elected a fellow of the Australian Academy of Science. After war-time experience with the British Non-Ferrous Metals Research Association on the application of spectroscopy to the analysis of metals and alloys, Mr. Walsh joined the CSIRO in 1946.

The first major success of his team was the introduction of a new principle on which was based a new type of spectrophotometer for splitting radiation into its constituent wavelengths. This instrument makes it possible to obtain very detailed spectra in a simple manner. Royalties on spectrophotometers of this type made under CSIRO licence by a US firm have already earned $70,000. A UK company is expected to start production later this year.

Mr. Walsh's studies of absorption of light by atoms led him to recognise the possibilities of atomic absorption in chemical analysis. With his colleagues he has since shown that absorption spectroscopy is a potent analytical tool. Already it is being applied in metallurgical analysis, in the analysis of trace elements in soils and plants and in many other fields.

★Lovers of fine wines may find it difficult, like me, to associate the use of ion exchange with the vineyard. But a new development which is said to promise further enjoyment to the wine lover is the US approval given for the use of Amberlite ion-exchange resins in the treatment of wines.

I learn that a recent decision by the Alcohol and Tobacco Tax Division of the US Department of Revenue now makes it possible to stabilise wines and reduce natural acidity by treatment with the Rohm and Haas Amberlite IR-120 cation exchanger and Amberlite LR-45, anion exchanger, in a fixed-bed column process.

Operating in the sodium cycle, product IR-120 converts potassium bitartrate to the more soluble sodium bitartrate, thereby eliminating not only haze, but the long holding-period needed in the chilling process. IR-45 is said to enable the vintner to control the degree of acidity by treating all of the wine or by blending de-acidified and untreated wine to the desired pH.

Alembic

WORLD SYMPOSIUM ON GAS CHROMATOGRAPHY

Delegates from 17 countries attended the Second Symposium on Gas Chromatography held by the Hydrocarbon Research Group of the Institute of Petroleum and Koninklijke Nederlandse Chemische Vereniging in Amsterdam on 20 to 22 May. Included among the 470 delegates were over 150 from the UK.

Financial support for the Symposium was given by : Algemene Kunstzijde Unie NV, Arnhem; Koninklijke/Shell-Laboratorium, Amsterdam; NV Organon, Oss; NV Philips Roxane; Pharmaceutisch-Chemische Industrie, 'Duphar', Weesp; NV Polak en Schwarz's Essence Fabrieken, Zaandam/Hilversum; Staatsmijnen in Limburg, Geleen; Unilever NV, Rotterdam.

The Symposium was divided into three sections covering the techniques, apparatus and the application of gas chromatography. Each section consisted of nine papers preceded by an introductory lecture.

In his opening address the chairman stressed the importance of gas chromatography. Its rapid growth during the last six years was shown by the numbers attending and he made especially welcome the originators of the technique, Dr. Martin and Dr. James. The theory section was introduced by Dr. J. J. van Deemter with a discussion on the relationship of the theoretical plates in a column and the sample size. He recommended that the plates in a column should be expressed at zero sample size. He stressed the importance of a study of capillary columns and said that for the development of large-scale columns, model column and mathematical interpretation would be needed especially in respect of sample addition and uniform flow through the column.

Chromatography in unpacked tubes. The theory and practice of gas chromatography was shown to have advanced in the papers by Dr. Dijkstra and Dr. Golay. They showed that coated capillaries could be used as columns for gas chromatography and that they were effective as packed columns. Golay showed that in a 150 ft. by 0.01 in. capillary he could obtain 50,000 theoretical plates, i.e. he could effect an almost complete separation of such close boiling materials as meta/para xylenes.

Another outstanding feature of this section was the mathematical analysis by Dr. Glueckauf of the effect of chromatographing highly radioactive vapours. He showed that the band in the column should contract because of the radioactive heat evolved. This was found to be so and should be of value in that it affords a simple means of concentrating dilute radioactive vapours into small volumes if the total radioactive power is in the watt range. The radioactive heat will, however, reduce the ease of separation of two compounds. It was shown by White and Cowan that an effective stationary phase could be reduced by replacing inorganic ions in a montmorillonite clay by an aliphatic amine with a long carbon chain. The paper evoked considerable discussion of the boundary between adsorption and partition chromatography.

Dr. Martin, introducing the techniques and apparatus section, outlined the changes that had taken place in the two years since the first symposium. New detectors had been introduced, some with the very high sensitivity needed for the high efficiency columns that were being developed. Some were for specialised operation and he saw the end of the universal and the beginning of the development of the automatic apparatus for routine analysis. He stressed the need to cut down the amount of recorder paper used and that the automatic integration of peak areas would be developed to meet that need.

He introduced the concept of the 'time of passage through a theoretical plate' as a means of measurement of the column efficiency. This embraces both the retention volume and flow rate. He saw a need of tailored stationary phase and a trend towards the high temperature working. He closed with an appeal to the manufacturers to cheapen their apparatus. Scientists, he said, did not chose an apparatus like a lady choosing a car.

New Detectors. The first of three papers on new techniques was introduced by I. G. McWilliam. He used the principle of change of ionisation of a hydrogen flame on passage of carbonaceous material into it. The detector was extremely sensitive, linear in response and had a good signal noise/ratio. He recommended its use for the detection of trace quantities. The second paper by D. W. Grant used the principle of change of emissivity of a coal gas flame on introduction of carbonaceous material. The detector was of use in the aromatic hydrocarbon field. The third detector described by W. Stuve was an impressively simple catharometer detector using the fine wire from an envelopeless flash lamp bulb as the sensing element.

J. E. Lovelock gave a brief dissertation on his argon ionising detector which had the extreme sensitivity of 10^{-13} moles of organic substance with linear response and stable base line. R. P. W. Scott then introduced a paper describing the construction and use of very high efficiency packed columns. This had efficiencies of up to 60,000 theoretical plates.

Other papers described the use of multiple columns for programmed heating for the analysis of wide boiling range points, the purification and precise control of the gas phase for suitability in detection, and a study of the hydrogen flame detector. Discussion centred around the precision of results obtained by gas chromatography.

The last day's technical sessions on applications of gas chromatography were introduced by Dr. H. H. Emmett who said that gas chromatography had been applied to the analysis of hydrocarbons with a chain length up to C_{37} and of fatty acid esters up to C_{22}. Important work had been carried out on the detection of adsorption isotherms using gas chromatography. The surface areas of solids had also been determined by the same technique. In the analysis of catalytic effects the technique had been used to great effect, a catalyst being placed at the top of the column so that its effect could be immediately assessed. He thought that preparative scale gas chromatography would increase. Two papers were then given on the automation of gas chromatography, on the preparative scale by Tuey and on the small scale by Hooimeijer. The latter said that circular chromatography was possible.

Corrosion by boiler waters. A paper by Bovijn showed that water corrosion of tubes in high pressure boilers could be easily detected by gas chromatography. His apparatus, which determined dissolved hydrogen, was semi-automatic. Further papers described the analysis of essential oils, amino acids, phenols and volatile halogen compounds.

The paper by J. F. Ellis described the difficulties encountered in the construction of an apparatus for the analysis of highly reactive fluorine compounds. C. J. S. Phillips said that metal salts of aliphatic long chain acids were effective stationary phases. The symposium closed with an address by Professor H. Gerding.

PAPERS PRESENTED AT THE SYMPOSIUM

Tuesday 20 May

Opening address by Dr. J. Boldingh (Chairman).

Section I

'Introductory lecture' by J. J. van Deemter; 'Some applications of theory in the attainment of high column efficiencies in gas-liquid chromatography' by J. Bohemen and J. H. Purnell; 'An examination of column efficiency in gas-liquid chromatography, using columns of wetted glass beads' by B. Littlewood; 'Theory of chromatography in open and coated tubular columns with round and rectangular cross-sections' by M. J. E. Golay; 'The use of coated capillaries as columns for gas chromatography' by G. Dijkstra and J. Goey; 'Theory of chromatography: Part XII: chromatography of highly radioactive gases' by E. Glueckauf; 'Sorption isotherms and chromatographic behaviour of vapours' by S. J. Gregg and R. Stock; 'The diffusion at a front in gas chromatography' by C. H. Bosanquet; 'Symmetrical elution curves in adsorption chromatography' by D. White and C. T. Cowan; 'The determination of activity coefficients at infinite dilution by gas-liquid chromatography' by A. Kwantes and G.W. A. Rijnders; 'A hydrodynamic model of sorption columns' by K. V. Chmutov and N. V. Filatova.

Wednesday 21 May

Section II

'Introductory lecture' by A. J. P. Martin; 'Flame ionisation detector for gas chromatography' by I. G. McWilliams and R. A. Dewar; 'An emissivity detector for gas chromatography' by D. W. Grant; 'Study of the hydrogen flame detector using nitrogen as carrier gas' by G. R. Primavesi, G. F. Oldham and R. J. Thompson; 'A simple katharometer for use with the combustion method' by W. Stuve; 'The construction of high-efficiency columns for the separation of hydrocarbons' by R. P. W. Scott; 'Operating data on two stationary phase supports' by D. H. Desty, F. M. Godfrey and C. L. A. Harbourn; 'The use of multiple columns and programmed column heating in the analysis of wide boiling range halogenated hydrocarbon samples' by G. F. Harrison, P. Knight, R. P. Kelley and M. T. Heath; 'Base line control in gas-liquid chromatography' by L. Guild, S. Bingham and F. Aul; 'Some quantitative aspects of the chromatographic analysis of gas mixtures using thermal conductivity as detection method' by F. van de Craats.

Thursday 22 May

Section III

'Introductory lecture' by Paul H. Emmett; 'An automatic "preparative-scale" gas chromatography apparatus' by A. P. Atkinson and G. A. P. Tuey; 'The automatisation of gas chromatography' by J. Hooimeijer, A. Kwants and F. van de Craats; 'The application of gas-liquid chromatography to the analysis of volatile halogen and interhalogen compounds' by J. F. Ellis and G. Iveson; 'Determination of hydrogen in water by means of gas chromatography' by L. Bovijn, J. Pirotte and A. Berger; 'Analysis of essential oils by gas chromatography' by A. Liberti and G. P. Cartoni; 'Separation of derivatives of amino acids using gas-liquid chromatography' by E. Bayer; 'Evaluation of some sugars as stationary phase for separation of phenols by gas chromatography' by J. Janak and R. Komers; 'Applications of high temperature gas-liquid chromatography in the petroleum industry' by E. R. Adlard and B. T. Whitham; 'The presentation of gas-liquid chromatographic retention data' by D. Ambrose and J. H. Purnell; 'Closing address' by Prof. H. Gerding (Chairman of the Koninklijke Nederlandse Chemische Vereniging).

NEW BRISTOL GAS FROM OIL PLANT WILL PRODUCE SULPHUR-FREE GAS

A NEW gas-making plant which will produce a gas which is completely clean, is free of sulphur, has no smell on combustion, and is almost non-toxic, is announced by Mr. C. H. Chester, chairman of the South West Gas Board. It will be the first of its kind in the country and is to be erected along the coast in the Bristol area.

In making the announcement on 2 June, Mr. Chester stated that one of the most important factors in the new process was that of capital costs, which would be only one-third that of a nuclear power station of the same heat output. He further pointed out that the space occupied by the plant would be roughly only one-eighth of the area occupied by a modern gas works.

This new process is different from the present methods of manufacturing gas. Coal is not used; and consequently there is no coke, tar or ammonia. The plant uses a by-product of the oil industry which is treated under high pressure in vessels constructed of special steel. The resulting gas is eminently suitable for use by the public because it is pure—i.e. it is completely free of sulphur, entirely clean, is free from smell on combustion, and is almost non-toxic.

There are, however, several valuable by-products of the process, the most important of which are chemically pure benzene, naphthalene, and granular carbon.

Mr. Chester pointed out that the new process would not involve the country in any special importation of crude oil, as the product used was already surplus from crude oil refining plants in Britain.

Board technicians are now making plans for the installation of the new plant, and it is estimated that it will be in operation about 1960/61.

Asked about costs, Mr. Chester said that the Board was confident that the cost of producing the 'new look' gas was going to be considerably cheaper than present methods utilising coal. This would benefit the gas consumer considerably. He added that after the first plant had been put into operation the Board would proceed with further installations without delay, so that in the space of a few years a large proportion of all the gas used in the south-west of England would be made by the new process.

New Premises for Glass Research Association

THE British Glass Industry Research Association is to have its own premises in Northumberland Road, Sheffield 10, comprising an experimental furnace area, specialised laboratories and office accommodation. A glass foundation 'stone' was laid on 30 May by the chairman of the association, Dr. Lawrence Pilkington.

Since its formation in 1955 (to take over the industrial research, testing and consultative side of the work concerned), the association has shared the quarters of the Department of Glass Technology, Sheffield University. A year ago, however, the demand for newly trained glass technologists became so great that the University department was faced with having to turn away students unless the association could evacuate the building by 1958. The laboratory areas in the new premises, erected on land rented from the University, are expected to be ready for use in September of this year.

Advantages of Synthetic Fibres Outlined at RIC Meeting

ATTENTION was drawn to the general advantages of synthetic fibres over those of natural origin at a recent meeting of the Royal Institute of Chemistry, London section. The speaker was Mr. I. Goodman of Imperial Chemical Industries Ltd.

A general description of such fibres could be as linear flexible macromolecules not less than 1,000 Å long and two to 15 Å in diameter. They should be regarded as being partly crystalline and partly amorphous.

X-ray examination of drawn Terylene fibre showed that it was not completely orientated and crystalline but included a proportion of amorphous region.

There was a connection, said Mr. Goodman, between molecular length and physical properties such as tenacity strength, extensibility, etc. Desirable properties could be imparted by suitable polymerisation treatment.

A new synthetic was polypropylene which, unlike polyethylene, could exist in three forms in which the methyl group orientations determined the structure and properties. The isotactic form (cis-cis) was a crystalline material, m.p. 170°C, which could be melt spun to give fibres. The atactic form (random) was a viscous elastomer which could not be made into a fibre. The syndyotactic was the cis-trans form.

Catalysts for making isotactic polypropylene appeared to be chlorides of molybdenum and titanium ($MoCl_3$ and $TiCl_4$) or mixtures of $TiCl_3$ with aluminium ethoxide ($Al(OEt)_3$) and the process was reminiscent of the cold method for manufacture of polyethylene (the Ziegler process).

Water Treatment Plant at New Berks Board Mill

WATER supplies for the new board mill of Colthrop Board and Paper Mills Ltd., which recently went into production at Thatcham, Berks, are drawn from the Kennet and Avon Canal.

A pumping station close to the canal, consisting of a Bracket rotating screen and three Mather and Platt automatically controlled borehole pumps, delivers water to a 320,000-gallon storage tank on the North Mill site.

The main water storage tank is at ground level and first supplies the power station with all its requirements. After being used for condenser cooling, the water is available for production purposes.

An instrument panel is provided in the power-station for remote control of this pumping station and is complete with canal and storage tank water level indicators and an alarm system which operates in the event of a pump failure or water shortage.

The surplus backwater from the mill is passed to a clarification plant situated near the preparation plant building. The equipment comprises a dump tank and splitter box, and two 50-ft. diameter Dorr clariflocculator tanks with rotating scraper mechanism capable of handling 600,000 gallons per day. Three Dorrco diaphragm pumps are used for the continuous withdrawal of sludge from the base of the clariflocculators, and this sludge is stored in a tank and returned to the 'middles' hydrapulper as required.

The clarified effluent is pumped to percolating filters south of the canal for further treatment before being returned to the canal.

As no public sewers exist for dealing with foul drainage, a septic tank with pumping plant is provided for the initial treatment and the effluent from this is pumped to the percolating filters mentioned above.

In addition to the main clarification plant there is a microstrainer, manufactured by Glenfield and Kennedy Ltd., which has been specially installed to treat the water from the top and bottom felt whipper showers on the board-making machine.

Built at a cost of £5 million, the new board mill is claimed to be one of the most advanced in the world. At peak capacity it will produce a continuous piece of board 110 in. wide and 160 miles long every day.

Synthetic Rubber Plant Contract

A CONTRACT for the mechanical engineering design of the synthetic rubber plant to be constructed at Pernis refinery, Holland, for the Royal Dutch/Shell Group has been awarded to Matthew Hall and Co. Ltd. This will be Holland's first synthetic rubber plant and will have a capacity of at least 50,000 tons per annum.

The decision to erect this plant has been based on extensive studies of the future world rubber requirements and supply position. Production is expected to commence in 1960. This is the second large synthetic rubber plant contract awarded to Matthew Hall and Co. Ltd.

CHEMISTRY AT BRUSSELS WORLD FAIR

Newly Developed Techniques Demonstrated in International Hall of Science

POLYMERISATION of Ziegler polyethylene in a demonstration unit; a graphic illuminated display of the chemical structure of isotactic polypropylene; the separation of rare earth elements in a pilot scale plant; liquid-liquid extraction apparatus in operation. These are some of the highlights of the International Hall of Science at the Brussels World Exhibition.

There is something in the hall to interest all chemists. Much of the work shown is claimed to be new; all of it is shown in an interesting fashion by means of demonstration units, 3-D representation and the imaginative use of many new display techniques.

This hall was the starting point of a tour of the exhibition made last week by those who attended the opening of the 2nd congress of the European Federation of Chemical Engineering. This congress continues this week at Frankfurt where it is being held in conjunction with the ACHEMA exhibition of chemical plant and equipment.

In the Hall of Science many nations combine to show the contribution that the scientist and technologist have made and are making in modern life. Scientists are available to expand on the details shown either in caption form, on cinema screens or provided by simultaneous translations through earphones.

Chemical Industry Pavilion

A chemical industry pavilion is devoted mainly to displays by leading Belgian chemical and chemical equipment companies. The only chemical firm to have a pavilion of its own is Solvay et Cie. Chemistry and chemical engineering are represented in a number of other pavilions, but with few exceptions mostly on a relatively small scale. The Soviet pavilion strongly emphasises that country's scientific and technological achievements. The United Kingdom pavilion does this pictorially and with the aid of a model of Zeta, the thermonuclear apparatus at Harwell. The second British pavilion, that dealing with industry is devoted to displays by UK industrial firms, including chemical producers.

Atomics are featured by a number of national pavilions, including those of the UK, but the main impact in this field is in the Hall of Science where some spectacular displays are made. Two of the spheres of the atomium, 102-metre high centrepiece of the exhibition, are devoted to telling the story of atomic energy for peaceful purposes.

The demonstration apparatus in the Hall of Science that produces Hostalen polyethylene on a laboratory scale is contributed by the West German firm of Hoechst. Ethylene gas is supplied from outside the hall; the brown powder catalyst is shown being mixed with a liquid, forming the so-called contact, followed by the polymerisation process. The material flows into another vessel where the contact is dissolved out with alcohol. The next steps shown are filtration, solvent extraction, drying in air and finally conversion of the powdered polyethylene into coloured granules, followed by injection moulding.

In the same section, two examp'es of Professor Natta's work are graphically shown. The first deals with the stereospecifics of olefins and diolefins, demonstrating the chemical structure of polypropylenes, polyethylene and polybutadiene. In the other an illuminated display and film combine to represent schematically the catalytic mechanism in the stereospecific polymerisation of propylene.

W. Kuhn and M. Thurkauf, Institute of Physical Chemistry, Basle University, show how a molecule of polyacrylic acid in water will be uncoiled on the addition of alkali and how it will contract if the alkaline solution is neutralised by the addition of an acid.

A molecule of polyacrylic acid built up from 500 units of acrylic acid and whose chemical formula reads $C_{1500}H_{2000}O_{1000}$ is represented, 200 million times enlarged, by a model. The change of the molecular shape produced by acid and alkali can be carried out on a macroscopic scale in a continuous experiment and alternatively a dilation and contraction of a filament containing some polyacrylic acid.

In the experiment, the bath in which the filament is suspended is made slightly alkaline and slightly acid alternatively, the alkaline bath being substituted in turn by an acid bath and vice-versa. The stretching of the polyacrylic acid molecules contained in the filament by the alkali produces a dilation, the subsequent coiling up in the acid bath a contraction of the filament as a whole.

The experiment proves the possibility of producing mechanical energy by making proper use of the shape and the change of shape of macromolecules.

Polyurethane chemistry is the subject of an exhibit by Farbenfabriken Bayer, and a special panel illustrates the formation of a polyurethane elastomer. Another exhibit of this company shows the work of Gerhard Schrader, explaining the development of the systemic insecticide Ompa. A further development of this compound was synthesised as the diethyl thionophosphoric ester of β-oxyethyl thioethyl ether which became known as Systox. In continuation of this work, Metasystox (methyl demeton) was developed, a product with a much lower order of mammalian toxicity.

An exhibit that has attracted attention is that describing 'A new systematic chemical discipline—phosphorus chemistry'. The table below outlines studies on long chain phosphates.

Experiments in Catalysis

In one of their exhibits, the Soviet Academy of Science shows a number of recent laboratory experiments. The first is a section of a catalytic reactor for the study of ammonia synthesis by the flow circulating method at pressures from 100 to 300 atm. The second is a laboratory installation for studying activity of ammonia synthesis catalysts with the aid of a new flow circulating method introduced by Professor Temkin, Kharkov Physical Chemistry Institute.

A third represents a model laboratory catalytic installation for studying reactions of catalysts in the semi-liquid state. Also shown is an apparatus with vacuum registering balance for studying the surface and porosity of catalysts and adsorbents by gas in vapour adsorption.

A large scale USSR exhibit dealing with chain reactions shows that the ion molecular processes of proton or atom transfer do not require activation energy as shown by their investigation in a mass spectrometer ion source. It is stated that these processes always occur when they are non-endothermic. A new way for the determination of certain important energetic values or dissociation energy is given by comparison of rates of different ion-molecular processes.

A US exhibit deals with organosilicons, organotins and organolead. Reference is

	Phosphates	Phosphoryl chlorides	Phosphonitrillic chlorides	Phosphimates
Typical pair of segments	O O -P-O-P-O- O O	O O -P-O-P-O- Cl Cl	Cl Cl -P-N-P-N- Cl Cl	O H O H -P-N-P-N- O O
Chemistry	Polyelectrolyte	Polar polymer	Polar polymer	Polyelectrolyte
Condition of amorphous solid containing long chains (no plasticiser)	Glass	Elastomer	Elastomer	Glass

Studies in long-chain phosphates

made to the exceptional stability, and inertness of copper phthalocyanine (CPA) because it is completely surrounded by an interlocking system of chelate rings.

In the organotin unit, structures described are tetrabutyltin; bis-tributyltin oxide; dibutyltindilaurate anthelmintic p.v.c. stabiliser.

The crystal growth of germanium at high pressures and high temperatures is depicted graphically as is the story of borazon. Some Soviet demonstrations are given in what are described as 'Newly elaborated catalysts—semi conductors'. These deal with Ge, Te, Ga_2As, Ga_2Te_3, GaAs, Ga_2Se_3.

An exhibit of interest to many visitors is that dealing with electron microscopy of a colloidal solution by Rehbender of the USSR Institute of Physical Chemistry, Academy of Science. This demonstration shows cuts of a mercury layer under water stabilised by a structurised adsorption layer of a surface-active addition. It is stated that liquid surface active lubricants facilitate pressure metal working as they soften thin metal layers.

The Czechoslovak Academy of Science shows a study of the structure of EDT by the Institute of Technical Physics. According to information gained by the use of electronic computing machines, a spatial model of the EDT crystal has been made. Another important Czech exhibit is a new instrument, a vibrating permalloy probe, which makes possible the study of the structure of ferromagnetic materials. A new original method of defectoscopy, which will be completely automatic, is already being developed.

The most extensive Czech contribution is devoted to polarography. This electrochemical technique, based on the work of Academician J. Heyrovsky, was in 1955 the fifth most frequently used analytical method in the world.

Metropolitan-Vickers show their type MS2 mass spectrometer, designed for the rapid and accurate analysis of organic and inorganic gases and vapours, and for the determination of the relative abundance of stable isotopes of the elements. A sectioned model of a mass spectrometer tube is also shown and is compared with a model of Aston's third mass spectograph, built at the Cavendish Laboratory, Cambridge University, in 1937.

Included among the many other exhibits are the catalytic oxidation of CO into CO_2 (Teichner, CNRS, France); chromatography, (Dr. A. J. James, M.D.E. Childs, Shandon Scientific Co., Hanovia Ltd. and Griffin and George Ltd.;) mechanisms of reactions (Professor N. B. Chapman, University of Hull); the chemical bands (Pauling, California Coll. Institute of Technology); separation of isotopes by thermal diffusion (Clusius, Zurich University); chemical construction of natural and synthetic rubber types (Rubber Stitchting, Delft, Holland); oxidation of nitric oxide; photosynthesis; mass spectrometry (USSR Academy of Science); ion exchange reactions and uranium recovery; counter current apparatus; separation of rare earth elements using ion exchange technique on synthetic resin beds (Trombes and Lorier).

ICI and Distillers in British Industries Pavilion

THE British Industries pavilion features four chemical companies. The largest of these exhibits is by Imperial Chemical Industries Ltd. One part of their stand is a picture gallery of many British chemical pioneers from Robert Boyle to Sir Alexander Fleming. Another section shows how ICI, who have direct historical connections with several of these pioneers, have built on the rich heritage of research bequeathed to them. A series of displays shows a number of recent chemical discoveries of world significance for which ICI research has been responsible or to which ICI development work has contributed.

Indications are given of the company's work on titanium and on metals for use in nuclear power plants. Also featured are industrial catalysts. The stand shows how the ICI organisation to-day extends through 44 countries.

It is stated that since the end of the war, the company's production has more than doubled, and that the company has spent more than £300 million on modernisation and the construction of new plants. Only recently, ICI purchased two 1,000-acre sites for further expansion, one in the north-west and the other in the south-west. Work on the latter, the Severn-side site, is already under way.

The large stand of the Distillers Co. Ltd. shows this company's activities in many fields. Visitors were able to take away copies of 'British Hydrocarbon Chemicals Ltd., 1958' a new booklet not yet generally distributed in the UK. This describes the products made at Grangemouth by BHC and associated companies.

Other exhibitors include: Darlington Chemicals Ltd., who show a range of insulation chemicals; Courtaulds Ltd., displaying a range of their man-made fibres, plastics and chemicals; Formica Ltd.; Nuclear Power Plant Co. Ltd.; and the UK Atomic Energy Authority, who particularly emphasise the range of radioisotopes available for industry and research.

A special stand of the Birmingham Exchange and Engineering Centre includes the ICI metals division and a number of engineering firms. The Morgan Crucible Co. Ltd. feature on this stand Crusilite, their new, non-metallic, electric furnace element. Crusilite is a one-piece silicon carbide tube produced by a new method which uses a spiral as the hot zone.

Town Gas from Milled Peat

Bord Na Mona (the Irish Turf Board) is investigating the possibilities of producing town gas from milled peat, and has engaged an engineer with experience in the process. The principal gas companies are co-operating.

CFO on Dangers of Unmarked Chemical Containers

THE considerable increase in the transport of dangerous chemical substances by road is referred to in the annual report of the chief fire officer of the North Riding of Yorkshire, Mr. Cyril Outhwaite. He comments that these substances in many cases could produce serious toxic effects and create fire hazards if involved in a fire or accident.

'In a very large number of cases', he says, 'the vehicles or containers of the substances are not marked with their contents. And when an accident occurred urgent inquiries had sometimes to be made before it was possible for the brigade to take action to safeguard life and property'.

In one case a tanker overturned and its contents spilled on to the road. Only after urgent inquiries did the officers discover that the chemical compound was inflammable, that quantities of its vapour would be dangerous to health, and that contact with the liquid would be liable to cause skin infection.

Mr. Outhwaite reveals that the problem is to be the subject of a paper and discussion at the annual conference of the Chief Fire Officers' Association later in the year.

Pressure Vessel Code Criticised

THE recently revised British Standard Code of Practice No. 1500 for chemical pressure vessels was criticised on Tuesday by Mr. W. Barr, research director of Colvilles Ltd. He was replying to the toast of 'The guests' at the annual dinner of the chemical engineering group, Society of Chemical Industry, which had been proposed by Mr. R. F. Stewart, chairman.

Stating that this was a vital matter both to metallurgists and chemical engineers, Mr. Barr, said that the permissible working stresses in the code represented a serious handicap, particularly in view of continental competition. It seemed that the British were living in the past; in certain cases it was possible for the UK designer to use twice as much steel in his pressure vessels than his rival on the Continent.

It was, he declared, a matter of urgency that the UK should rationalise its codes of practice along lines similar to those operating in other countries so that full advantage could be taken of good design, excellent workmanship and first-class steels.

The toast of 'The Society of Chemical Industry' was proposed by Mr. E. W. Greensmith, group vice-chairman.

Princess Alexandra Sees Boots' Cortisone Plant

One of the most modern cortisone manufacturing plants in Europe was seen by Princess Alexandra during her visit to Nottingham on Thursday when she opened the new £940,000 District Technical College. The Beeston factory of the Boots Pure Drug Co. Ltd. was also visited by Princess Alexandra's father, the late Duke of Kent, 17 years ago.

CHEMICAL ENGINEERING CONGRESS OPENS AT BRUSSELS FAIR

THE second congress, 1958, of the European Federation of Chemical Engineering, which is being held in Frankfurt this week in connection with the ACHEMA exhibition, opened last week in Brussels. The official inauguration was held in the Grand Auditorium of the Brussels World Exhibition on 28 May. Opening speeches were made by the Belgian Minister of Economic Affairs and by Mr. Van Cauwenberghe, president of the Société Royale Belge des Ingénieurs et Industriels.

About 12 congress members from the UK attended the Brussels section; a much larger contingent travelled direct to Frankfurt for the main part of the congress.

Three papers were given in the Brussels part of the congress. Speakers were Professor E. Mertens de Wilmars ('Modern aspects of the calculation of reactors') who was introduced by Dr. Van Rysselberghe, director of the Sofina Laboratories; M. Pierre Baar ('Role of the engineering office in the field of chemical engineering') introduced by Dr. Paul Ferrero, research director, Société Carbochimique, in Tertre; and Dr. André Macq ('Manufacturer's problem in selecting a process'), introduced by Professor C. Guillissen, Brussels University.

In addition to the lectures, members were also taken on a tour of the exhibition, starting at the International Hall of Science, where many chemistry exhibits were inspected. Also visited by the party were the Belgian pavilion of the chemical industry, where a cocktail party was held by the Brussels organising committee, and the stand of Solvay et Cie. In addition, two films—'Les alchimistes' and 'Le styrene'—were shown by Pechiney in the French pavilion.

The official congress banquet was held at the Belgian Hall of Gas on 29 May and was attended by more than 600 congress members and their ladies. The following morning those attending the congress travelled by train or plane to Frankfurt. Proceedings there will be reported in CHEMICAL AGE next week.

Use of Kinetics may Lead to Better Chemical Productivity

OUTPUT of the synthesis columns, which measured 0.80 metres in diameter and were 12 metres high, at Oppau 30 years ago hardly exceeded 25 tons of ammonia a day. Distillation of the resulting ammoniacal solution called for almost 30 tons of steam. Now columns of about the same size produce 100 tons of anhydrous ammonia a day and supply at the same time 90 tons of steam through the heat of reaction. Units capable of producing 250 tons of ammonia a day are being built and will supply the same quantity of steam each day.

During the same 30 years, world production of ammonia has increased from 500,000 tons a year to more than 7 million tons a year.

These figures were given by Professor E. Mertens de Wilmars, director of the Institute for Industrial Chemistry and Chemical Engineering, Louvain University, in his paper on 'Modern aspects of the calculation of reactors'.

Discussing the liquid-phase reactors, the professor said that the equilibrium constant was of great importance. Its interest was a dual one. Firstly, it was necessary for determining the limit concentrations; it also entered into the expression of the kinetic functions. The equilibrium constant was often strongly influenced by the temperature fluctuations. Thus, in the now classical synthesis of ammonia, the ratio of the equilibrium constants at temperatures of 400° and 800°C respectively was 35, whereas the variation of enthalpy under the reference conditions only amounted to $H_{298°} = 10.960$ cal/mole. This magnitude had to be known precisely.

The same applied to specific heat which was also a function of temperature and the exact value of which was still lacking for many substances. When thermodynamical factors were exactly known, the problem of kinetics was reached. The only way to meet steeply increasing competition in chemicals was by speeding production, i.e. by applying more rapid and more efficient production methods.

That was why applied kinetics would play an increasingly vital role in the chemical industry.

In the calculation of liquid-phase reactors, knowledge of the velocity constant and of the order of the reaction would often supply the means of solving the problem. In other cases a correct expression for the reaction velocity was necessary. This occurred when studying the gaseous phase reaction performed over a solid catalyst, where it was essential to express the progress of the reaction as a function of the length of the reactor. This occurred particularly in autothermal reactors; those which maintained temperature level by variation of enthalpy of the reaction.

Kinetics were still of paramount importance when dealing with successive reactions. In those cases, a selection of the reactions could be obtained, leading to a considerable increase of output by realising the most favourable succession of temperatures.

In many organic reactions, kinetics could not yet supply the data needed for a quantitative application of the theory. However, the almost daily progress made in kinetics meant that they would soon make a steadily growing contribution to the problem of calculating reactors and, as a result, to the productivity of the chemical industry.

A great advance would be achieved if kinetics could make it possible to forecast, with the aid of a simple laboratory test, the way in which reactions evolved and thus to know, starting from a given composition of the reacting substances, that of the reaction products. With such tests, the working conditions of a reactor, its form and dimensions, could be determined as could the nature of the operations which should follow the conversion in the reactor, namely, the separation and refining reactions.

To that series of calculations should be added the question of temperature exchanges, a problem which appeared in all its complexity when studying gaseous phase reactions on solid catalysts. When using a catalyst in a fixed bed, the difficulty stemmed from the low thermal conductivity of the catalyst mass. For strongly exothermal reactions, the removal of heat was difficult and there was a tendency to local superheating. Such was the case in ammonia synthesis, which took place adiabatically

Qualities required in a Chemical Engineer

IN his paper on 'The role of the engineering office in the field of chemical engineering', M. Pierre Baar, director of the department, 'Etudes et Entreprises', Société Belge de l'Azote et des Produits Chimiques du Marly, described the qualities required in an engineer of the engineering office. From a technical point of view what was required was a thorough knowledge of physics and thermodynamics, kinetics, knowledge of electricity, electronics, mechanics, resistances of materials and metallurgy. In addition the engineer had to have a general knowledge of chemistry.

From a general point of view, a practical knowledge of the French, English and German languages was of fundamental importance. Other requirements were a sense of general management, cost-price calculation and the significance of administration; sense of economy in the execution of his duties, without a tendency to luxury or avarice; plus common sense, a sense of observation, a spirit of enterprise and speed in reaction.

From a moral point of view, M. Baar sought tenacity, education, culture and good temper. The engineer also had to have an excellent digestion and should always be fresh and brisk the day after meetings, even if they had been protracted to a late hour.

M. Baar felt that the universities could not yet supply so complete an education, although he hoped that a place might be reserved for them in the future so that the many facets of the chemical engineer could be catered for.

at a starting temperature of 450°C; for a degree of conversion of 0.1, the temperature increase would be 180°, making a final temperature of 630°C.

Professor de Wilmars then examined more closely two examples of calculation relating to types of reactors that have recently been of interest. The two types belonged to a classification based on the phases used. Should R_1 and R_2 represent the reacting substances, P the reaction product, and F the phases, the cases considered were:

(1) Reactions in a homogeneous liquid phase, the reaction product being present in the same phase:

$$R_1F + R_2F \rightarrow PF$$

(2) Reactions in a gaseous phase over a solid catalyst, the reaction product being present in the gaseous phase:

$$R_1F + R_2F \xrightarrow{KS} PF$$

where K represents the catalyst which is in a solid phase.

Drawbacks of By-products in Chemical Processing

WHY restudy a process already investigated by someone else if it can be bought cheaper or at the price it would have cost to have studied it? That question was posed by Dr. André Macq, general adviser, Union Chimique Belge, in his paper 'Manufacturer's problem in selecting a process'. Dr. Macq said that when a process was bought royalties had to be paid, but the fact of buying a process guaranteed both its secrecy, the protective licences and the information exchanged later by licensees.

Negotiations would have to cover qualifications of the new product, its possible volume of sale; exclusivity granted to dealers would form the basis for royalties. For a pharmaceutical product, the success of which might not endure, the licence might cost about 30 per cent of the price of sale, while for an important chemical, the rate might well fall to 2 per cent or even lower.

New products, maintained Dr. Macq, should be studied and developed by the purchaser in order to assume fully his responsibilities. Such a policy ensured exclusivity and it brought in the useful influence of licences.

Earlier in his paper, Dr. Macq referred to the problem posed by forming by-products by reason of the raw material or technique chosen. As soon as demand for a product slackened, the by-product would inevitably also be unfavourably influenced. There was no doubt that so long as it was sufficiently large, a line without a by-product and able to make use of a wide range of raw materials was the best and simplest operating method. There was no interdependence, either for manufacture or in selling.

Certain companies viewed the by-product as an opportunity of widening their product range, but that did not mean that the disadvantages would disappear. A by-product of outstanding value might be acceptable, but its cost of production could transform the by-product into the main output. If the by-product had no value, it must be completely eliminated. If that was not done, manufacture might become impossible. That was why the choice of raw material in any process was of vital importance.

Food Research Panels to Meet in Provinces

The British Food Manufacturing Industries' Research Association is to hold group panel meetings in centres conveniently situated to member firms, whose works and offices are remote from London. This was stated by Dr. F. H. Banfield, director of research, at a recent meeting in Edinburgh of the association's cocoa and chocolate and sugar confectionery groups.

Within the ten groups comprising the food industry as a whole there are panels covering research on: bakers' prepared materials; cocoa and chocolate; sugar confectionery; jams and preserves; meat and fish products, including canned products; edible oils and fats; and pickles.

German Interest in Pyrethrum

At the African pyrethrum stand at the Crop Protection and Pest Control Exhibition were Dr. J. Luttmer [second left] and Dr. H. Stummeyer [second right] from BASF. With them are Eric Spearking, Pyrethrum Board of Kenya, right, and J. C. Oldfield

Why not 'Polythene'— or 'Polymethylene'?

(Letter to the Editor)

SIR, I was very interested to read Alembic's comments on page 828 of your issue of 3 May, with reference to the question of the preference for 'polythene' over 'polyethylene.' It appears that at the present time Britain is alone in referring to the polymers based on ethylene as polythene, the rest of the world preferring to use what is reputed to be the more accurate chemical term, polyethylene.

In reviews and lectures I myself had conformed to what I thought was accepted chemical practice and had used the term polyethylene. When, however, a year or so ago the British Plastics Federation decided that it would support the use of the more simple polythene, I felt in duty bound and in the interest of uniformity of reference in this country, to conform with this suggestion. I must confess that my sense for the euphonious triumphed over my desire for chemical accuracy in that I feel that polythene rolls more easily from the tongue and is equally more easy on the ear. Likewise I must confess that when writing reviews for the lay reader, I have used both terms, polyethylene in brackets, in order that there shall be no misunderstanding.

I am a little surprised to note that the chemical purists argue for the greater accuracy of polyethylene, with special reference to the later low-pressure products which have the more linear structure. One can anticipate a more orderly molecular arrangement in such cases, but here indeed, as in the earlier high-pressure materials, precise prediction of structure would be somewhat rash. Who can say indeed if it is polyethylene or polymethylene: so why not polythene?

Yours, etc.,

V. E. YARSLEY.

Yarsley Research Laboratories Ltd.,
Chessington, Surrey.

New Specification for High Density Polyethylene Tubing

A SPECIFICATION for tube for cold water services made from black high density polyethylene has been prepared by the British Plastics Federation. Materials are to consist only of high density polyethylene to which is added 2 to 3 per cent by weight of carbon black and 0.2 per cent to 0.3 per cent of a suitable anti-oxidant (i.e. N,N'-di-2-naphthyl-p-phenylene-diamine or N-stearoyl-p-amino-phenol), all evenly dispersed. Specific gravity is to be greater than 0.93 and the melt flow index such that not more than 0.8 g. are extruded in ten minutes.

Also detailed are stress rupture tests at elevated temperatures, dimensions, tensile tests, pressure tolerances, etc.

The relevant publication, price 1s., may be obtained from the federation at 47/48 Piccadilly, London W1.

Photonometric Titrimetry A New Technique?

Dispenses with the Burette

THERE are many physico-chemical methods of titration, but with the exception of the coulometric technique they are all methods which differ only in the means used to locate the equivalence-point. Coulometric titrations are exceptional in that the reagent is not added from a burette, but is generated internally or externally by the passage of a constant current of electricity. Thus time and the electron replace volume and primary standard and since both time and current can be measured with very high precision, coulometric titrations can be made very accurate.

Now, a new technique of titration has been born which closely resembles coulometry in several respects. In *photonometric* titration, the reactive species is generated in the solution by photolysis and measurement is made of the intensity and time of irradiation.

In coulometry, the ion being determined is not directly oxidised or reduced, etc., but 100 per cent titration efficiency is obtained by using an intermediate ion which transfers the electrons and returns to its original form. Similarly in this new technique it is found that 100 per cent efficiency can only be obtained when a product from the primary photolysis reacts with the ion being determined and returns to its original state.

In their paper describing this new technique, Bricker and Schonberg (1) make use of the photodecomposition of iron (III) to iron (II) in the presence of oxalic acid. The iron (II) thus produced, was used to reduce vanadium (V) and chromium (VI). The amount of vanadium (IV) formed during the reaction was measured absorptiometrically so that at constant intensity of irradiation a plot of absorbance at 750 mμ against time of irradiation shows a rising straight line passing through the origin and breaking sharply at the equivalence-point to give another line which is virtually parallel to the time axis. The reduction of chromium (VI) can be followed similarly at 575 mμ. Conditions were established for the titration of mixtures of vanadium (V) and chromium (VI).

Limited Scope

So far, the scope of this method is limited and it is not possible to make any pronouncement regarding its future. As mentioned previously, it is possible to measure time with high precision so that the main requirement is a constant light source.

Bricker and Schonberg operated a mercury vapour lamp from a constant voltage transformer and a Variac, and succeeded in obtaining constancy of radiation for a period of 4 months. Although they used a spectrophotometer to follow the course of the titration, there appears to be no reason why other physico-chemical methods of end-point detection should not be used.

There appears to be little doubt that many other photochemical reactions could be used to produce redox, acid-base and precipitation reactions, so that in all probability there need be no restriction of the field of application. What is more disturbing, however, is the empirical nature of the method as it stands at present. The efficiency of the titration is dependent on the quantum yield of the primary photolysis reaction. Since the stoicheiometry of the iron (III) reduction is not known, empirical standardisation is therefore necessary.

It may well be, however, that further research will resolve this problem, but until this has been done it would be foolhardy to predict success for this new method beyond noting that, like photometric titration, it might well have advantages over other physico-chemical methods which are electrochemical in nature and therefore subject to several sources of interference which would not affect a method dependent only on optical phenomena. The authors have indicated that further work is in progress.

In passing, it may be of interest to note that the authors comment on the effect of the field of the rotating magnetic stirrer on the photocell of their spectrophotometer. They adopted the precaution of stopping the stirrer and turning the magnet into a preselected position whilst taking measurements of absorbance. A similar effect of magnetic stirring has been noted on potentiometric titrations by several authors.

Metallochromic indicators.—A review of work carried out in the analytical laboratories of the Czechoslovak Academy of Sciences on the development of new indicator substances for the titration of various metal ions with complexones such as EDTA, has been described in a recent paper by Dr. Přibil in *The Analyst*. The major indicators dealt with are xylenol orange, calcein, methylthymol blue, thymolphthalexone, glycinethymol blue and glycinethymol red (2).

The first three indicators are commercially available in this country. Xylenol orange is perhaps one of the best complexometric indicators so far devised and is now sufficiently well established in the titration of bismuth, lead, zinc and cadmium, etc., to require no further mention here. Calcein, first synthesised by Diehl and Ellingboe (3) by exploiting the Mannich condensation between iminodiacetic acid, formaldehyde and fluorescein, has been obtained in a purer state by Körbl and Vydra.

In the most recent issue of the *Collection of Czechoslovak Chemical Communications*, these workers found that they did not obtain a colour change from brown to yellow-green at the Ca^{2+}/EDTA end-point as did the original authors, but noted only a quenching of the green-fluorescence (4). The red background colour of the indicator remained unaffected. In alkaline solution end-points were obtained with Ca^{2+}, Sr_2^{+}, Ba^{2+}, Cu^{2+}, Al^{3+}, Zn^{2+} and Mg^{2+}. In acid solution Hg^{2+}, Cu^{2+}, Ni^{2+} and Zn^{2+} quench the fluorescence of the dye, but it is not yet known whether this reaction may be exploited for analytical purposes.

Sensitivity

The authors point out that because of the sensitivity of this 'metallofluorescent' indicator for Ca^{2+} ions, etc., distinct end-points may be obtained in daylight with 0.02 M EDTA, and with U/V light 0.002 M reagents may be used. Titrations may be carried out in highly coloured solutions, e.g. a solution containing Mn^{2+} masked with triethanolamine. This fact may be one of considerable importance to those who are faced with the problem of determining calcium, etc., in dark coloured industrial solutions.

Methylthymol blue, a newcomer to the scene, is similar in structure and properties to xylenol orange. It is yellow in acid solution, light blue at pH 6.5–8.5, grey at 10.5–11.6 and dark blue above pH 12.7. It can be used for the titration of all the ions for which xylenol orange is used, but can also be used for the alkaline earths in alkaline solution. The yellow to blue end-point in acid solution is sharp and the writer can confirm that the end-point in the titration of calcium in alkaline solution is among one of the sharpest.

It is his experience, however, that both methylthymol blue and calcein give low results in the titration of calcium in solutions containing quite small amounts of magnesium. Indeed with methylthymol blue it is sometimes not possible to obtain a permanent Ca^{2+} end-point because of the presence of magnesium (5). The indicator is, in contrast to xylenol orange, noticeably unstable in solution and is best used as a dispersion in potassium nitrate.

Glycinethymol blue and glycinecresol red are prepared analogously from thymol blue formaldehyde and glycine and from cresol red, formaldehyde and glycine respectively. They are more selective in their action because of the weaker chelating power of the glycine group. Thus according to

by

T. S. WEST, Ph.D.

In this article in his 'Analytical Review' series, Dr. West features:

- **A new technique of titration which dispenses with the burette by generating the reagent *in situ* by photolysis.**
- **Some new metallochromic indicators for use in acid and alkaline solution.**
- **The indicator action of 'Calcein'.**
- **Some new colour reactions of catechol violet.**

Přibil it is almost specific for copper. This does not, of course, mean that the EDTA titration for copper is specific. Other metals which react with EDTA in acid solution will interfere unless they chelate much more weakly than copper.

Thymolphthalexone is similar in structure and behaviour to phthalein complexone. However, its acid-base transition lies at a higher pH and so the colour change obtained in the titration of the alkaline earths (from deep blue to near colourless yellow) is superior.

Catechol violet which has already achieved widespread use as indicator for the complexometric titration of bismuth and thorium in acid solution and for several other metals in alkaline solution has been applied recently for the detection of boron, germanium, niobium and tantalum. At pH 6–7 germanium produces a purple-red colour, boron gives a rose-red and niobium and tantalum blue-red (6).

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Chivers Chemist on Food Preservation

THE indispensibility of food preservation in the present state of civilisation and world population was discussed by Miss Mamie Olliver of Chivers Ltd. at a recent Ladies Night held by the Royal Institute of Chemistry, London section, at the Royal Institution.

After touching briefly on the preservation of food in the field by the use of chemicals to control or prevent insect or fungal damage she went on to deal with the main causes of spoilage of foods after harvesting.

Among topics specially mentioned were the heat resistant mould *Byssochlamys fulva*, the effects of enzymes, and chemical changes developing in process foods on storage.

Miss Olliver then dealt with methods of food preservation such as canning, freezing, dehydration and preserving with sugar. Brief reference was made to brining, salting, pickling, smoking, gas storage and use of treated fruit wrappers.

The construction of a can and the canning process itself were illustrated by lantern slides, and the main types of spoilage of canned foods described. The effects of rapid and slow freezing of fruit and vegetables were demonstrated.

Methods of food preservation that are being investigated for the future, she went on, are the use of antibiotics (aureomycin and terramycin were already in use on the other side of the Atlantic for preserving poultry and fish) and irradiation.

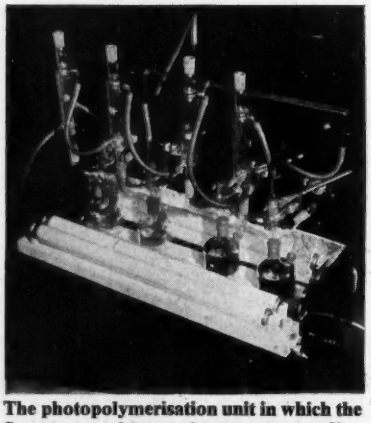
Birmingham Chemistry Workers Devise Photopolymerisation Apparatus

A CONVENIENT apparatus for the demonstration of photosensitised polymerisation in solution has been designed in the laboratories of the chemistry department, Birmingham University, Edgbaston, Birmingham 15, by Dr. J. H. Turnbull and W. Massingham.

The system, shown in the photograph, essentially comprises a light source consisting of a battery of three doublet fluorescent tubes (Mazda M.CF/U 20 watt 2 feet, daylight type) mounted horizontally in a trough. Two doublets lie along opposite sides of the trough, the third lying in the base. The adoption of a longer unit of similar design would permit the use of three, four, or five feet tubes if required. Experimental solutions in four two-necked flasks (Pyrex 100 c.c., B24, B14), fitted with reflux condensers and nitrogen inlets are mounted in the trough, one side of which is hinged to permit convenient manipulation. The solutions may thus be irradiated efficiently by the system.

When reduced intensity of irradiation is desirable, the doublet in the base of the trough may be cut out by a switch. Where light of a specific range of wavelengths is required, the flasks may be enclosed in beakers coated with Ilford filter gelatine of the appropriate colour selected with reference to the emission spectrum of the particular tubes employed.

In a typical experiment (cf. Whyte and Melville, *J. Soc. Dyers and Colourists*, 1949, **65**, 703) vinyl monomer solutions are irradiated in the presence of photosensitising substances, the rate of photopolymerisation being followed by a viscosity method. Conversely the apparatus may be used to study photodegradation of polymers. This is conveniently illustrated in the case of hyaluronic acid (cf. Castellani, 'Proc. First Internat. Photobiolog. Congress', 1954, 409) photodegradation of which, in the presence of sensitising dyes, may be simply demonstrated in the system by the foregoing technique.



The photopolymerisation unit in which the fluorescent tubes can be seen surrounding the reaction flasks

Organic Synthesis Using Aluminium Trialkyls

ALUMINIUM trialkyls have been used by two Russian chemists, L. I. Zakharkin and O. J. Okhlobystin, for the synthesis of a variety of organic compounds. For example, triisobutyl boron may be obtained by adding boron fluoride etherate to triisobutyl aluminium at 60–65 °C (yield 60 per cent). Triethyl boron is obtained if gaseous BF_3 is passed through a solution of triethyl aluminium in decahydronaphthalene.

Triisobutyl aluminium etherate reacts equally easily with SbF_3 (as an ether suspension), forming triisobutyl stibine (yield 77 per cent) while the principal products obtained when triisobutyl aluminium reacts with $AsCl_3$ in ether are isobutyl dichloroarsine and diisobutyl chloroarsine. The reaction with PCl_3 takes a more complicated course, a complex being formed by the reaction products and $AlCl_3$. Isobutyl dichlorophosphine of boiling point 148° to 149 °C was isolated.

The action of triisobutyl or triethyl aluminium on equimolar amounts of $HgBr_2$ in ether or hexane results in the formation chiefly of symmetrical Hg-dialkyl derivatives, e.g. diisobutyl mercury, as well as isobutyl mercury bromide (C_4H_9HgBr), from triisobutyl aluminium and HgBr or of diethyl mercury from triethyl aluminium and $HgCl_2$; $SnCl_4$ and triisobutyl aluminium at 40° to 48° yielded, after subsequent decomposition with caustic soda, tetraisobutyl tin (53.6 per cent) in addition to triisobutyl stannic chloride. Fuller details are in *Doklady Akademiyi Nauk, SSSR* (Reports of the Academy of Sciences of the USSR), 1957, **116**, 236–38.

Reduction of Nitriles by Organic Aluminium Hydride

REDUCTION of nitriles to aldehydes using diisobutyl aluminium hydride has been reported by two Russian workers, L. I. Zakharkin and I. M. Khorlina, *Dok. Akad. Nauk, SSSR* (Reports of the Academy of Sciences of the USSR), 1957, **116**, 422.

The reduction is carried out in a nitrogen atmosphere at 0 to 40 °C by adding the solution of diisobutyl aluminium hydride in slight excess to the nitrile solution (in ether, benzene, heptane, etc.), in drops and pouring the reaction mixture, after stirring it for another 30 minutes, on to a mixture of ice and 10 per cent sulphuric or acetic acid. The reaction proceeds particularly well with aromatic nitriles, the yield amounting to 80–90 per cent. Investigated was the reduction of butyronitrile, capronitrile, benzonitrile, nitriles of phenylacetic, anisic, α-naphthoic, pyromucic and terephthalic acid.

Kelvin Hughes Demonstration Unit to Tour Europe

A mobile demonstration unit has been sent by Kelvin and Hughes (Industrial) Ltd. on a four months tour of Eastern Europe, visiting Poland, Czechoslovakia, Hungary, Rumania and Jugoslavia.

Equipment caried in the unit includes high frequency recording equipment, ultrasonic flaw detection equipment, gas analysis equipment and electro-medical equipment.

Overseas News

WEST GERMANY SHIPPED MORE CHEMICALS TO ALL CONTINENTS IN 1957

EXPORTS of chemical products from West Germany in 1957 were valued at DM.4,500 million. Shipments of chemical products to North and Central American countries rose by DM.62 million to DM.421 million. Sales to the US rose by one-fifth to DM.246 million, placing this market third in the list of West Germany's overseas markets for chemicals. Sales to Latin American markets have risen, too, and totalled DM.327 million, or DM.65 million more than in 1956.

Trade with markets in Asia rose by DM.76 million to DM.685 million, but the percentage figure related to the entire export of chemicals fell to 15.2 as compared with 15.6 in 1956 and 16.3 in 1955. This development was due to reduced purchases by India and Japan. On the other hand, business with China was well maintained and a marked expansion took place in trading with Pakistan.

Trade with African markets developed favourably. Egypt regained its position as a leading market and sales are reported to have almost doubled, largely due to a sharp increase in exports of fertilisers. Business with the Union of South Africa was satisfactory. Overall, sales on the continent of Africa rose by DM.72 million to DM.223 million.

Export sales to European markets increased in 1957 by DM.308 million to DM.2,750 million. Holland was again the chief customer absorbing goods worth DM.288 million, followed by Italy with DM.255 million, Switzerland with DM.244 million, France with DM.236 million, and Austria with DM.225 million. The common market area accounted for 22 per cent of West Germany's total exports of chemical products, a slight decline against 1956, when the figure stood at 23½ per cent. If these figures are related to the proposed European Free Trade Area, they read 53.4 and 51.1 per cent respectively.

Import Bill Up

West Germany's imports of chemical products rose last year by 21 per cent to DM.1,620 million. This figure does not include 'technical oils and fats' which stood at DM.262 million, although a considerable proportion of these products are being processed by the chemical industry. Marked increases occurred in the import of pharmaceutical products, plastics, ferro-alloys, and also of industrial chemicals. Chemical raw materials worth DM.321 million were imported, equal to 20 per cent of total imports, as compared with 25 per cent in 1951. The main import items were sulphur ores and raw phosphates.

Just over one-half of total imports originated in other European countries, Switzerland being the leading supplier with DM.139 million. Much of this trade relates to the despatch of intermediate products to German subsidiaries of Swiss parent concerns. Other main suppliers are the UK, the Netherlands, Belgium and France. The five member countries of the Common Market Area supplied together 23.1 per cent of West Germany's chemical imports (45.7 per cent if related to the Free Trade Area). Purchases from the US rose by over one-third to DM.437 million. Imports from Japan, chiefly of ferro-alloys, have been almost doubled at DM.45 million.

'Pure and Applied' Congress

The 17th international Congress of Pure and Applied Chemistry (IUPAC) will be held in Munich from 30 August to 6 September, 1959. There will be eight main lectures and about 12 congress lectures of 45 minutes each. Six of the main papers will deal with experimental inorganic chemistry, one with applied chemistry and one with biochemistry.

For the biochemistry symposium, topics are being chosen from the general classification of new types of dyes and their biogenesis and the action of fat-soluble vitamins and hormones.

New Naphthalene Scrubber

A new design of a naphthalene scrubber first used early last year is to be brought into operation at the chemical recovery plant of the US Steel Corporation, Gary, Ind., US, this month. The scrubber, working on gas from the coke ovens, removes naphthalene which normally remains in the gas following cooling. This method eliminates the clogging of mains and towers.

The precipitator in conventional coke-oven-gas cleaning units has been replaced with the scrubber, reducing naphthalene dewpoint below 75°F temperature of the final gas cooler. Finished gas is said to contain less naphthalene than discharge from a conventional gas-cleaning unit which depends on the light-oil scrubber to remove naphthalene.

Research Spending in US

US Government-sponsored research and development amounts to 2 per cent of similar work carried out by the chemical and petroleum industries, according to the US National Science Foundation. Chemical and petroleum companies spent $762 million on research and development in 1956, a 50 per cent increase on 1953.

Polyethylene Production to be Increased

Production of polyethylene film by Crown Zellerbach Corporation of the US will be increased by the construction of a new plant at Orange, Texas. Under an agreement concluded between Crown Zellerbach and Spencer Chemical Co., Crown Zellerbach will purchase resin for the Orange plant from Spencer for an extended period.

Construction of the new plant will begin in the near future and it is expected to start operating by the late summer.

General Electric Offers Man-Made Diamonds

Man-made industrial diamonds are now available in commercial quantities for export from the US by International General Electric of New York, it is announced. They range from fine sand to coarse sand grain size. These particles, known as bort, are bonded in a plastic covering the shell. In the grinding operation the softer plastic wears away exposing the hard diamonds. The man-made diamonds, more rough surfaced than the natural, holds better in the plastic, reducing loss.

Butyl Rubber's Upper Temperature Increased

The upper temperature limit of serviceability of butyl rubber may be increased by 100°F by using a new sulphurless curing system it was stated at the recent Cincinnati meeting of the American Chemical Society's division of rubber chemistry.

The new process uses 2,6-dimethyl-4-hydrocarbylphenol or its condensation polymers. Butyl rubber vulcanised this way is said to show no tendency to revert even when held at vulcanising temperatures for long periods.

US Salk Vaccine Producers Indicted for Price Fixing

Five US Salk vaccine producers, Eli Lilly, Allied Laboratories, Merck, American Home Products, and Parke, Davis, have been indicted by a federal grand jury at Trenton, NJ, US, for price fixing in violation of antitrust laws.

The charges arise from accusations made last year by Milwaukee city officials who received 11 identical bids of $5.586 per 9-c.c. vial. According to Mr. John Connor, Merck president, 'these price decisions were made independently in conformity with the law and public interest'.

Five reductions in vaccine prices have been made since 1955; total reductions come to more than 50 per cent. Eli Lilly say they have given the Government a discount of 52.5 per cent from list price on all vaccine paid for by Government agencies. The company's average profit was only 6¼ cents per dose.

Argentine Borax Production

Argentine production of crude borax is 36,000 tons a year. Refined borax production is 18,000 to 20,000 tons and boric acid 2,400 to 3,000 tons a year.

New Shell Intermediates

Research quantities of 3-sulpholene and some of its derivatives are now being made by Shell Development Co., US. The derivatives are: sulpholane, allyl-3-sulpholanyl-ether, and 4-chloro-3-sulpholanol.

The 3-sulpholene is suggested for use as an intermediate. It reacts with chlorine in the absence of water to form the dichloro

derivative and in the presence of water to form derivatives. Shell state that 3-sulpholene is a controlled source of pure sulphur dioxide. It decomposes to sulphur dioxide and butadiene at a rate of 0.1 per cent per hour at 70°C and 8.4 per cent per hour at 100°C.

Sulpholane is a solvent for many organic compounds, resins and plastics. Allyl-3-sulpholanyl ether, a liquid, has been found to increase solubility and flexibility of copolymers, while 4-chloro-3-sulpholanol is a high-melting solid, which forms a polymer when treated with caustic soda.

Indian Council to Promote Chemicals

An Indian export council for chemicals and allied products has been set up recently with the support of the Government of India. Its object will be to maintain and promote exports of all chemical, pharmaceutical and allied products. The council will consist of 11 panels: pharmaceuticals and fine chemicals, glass and glassware, ceramics and enamels, acids and fertilisers, alkalis, dyes, salt and heavy chemicals, miscellaneous products, toiletries, rubber, and paints.

Mr. Charat Ram, president of the Indian Chemical Manufacturers' Association of Calcutta, will be the first chairman of the new council which will include representatives of the Government, manufacturers and exporters.

Dow Produce Neutral Trichloroethylene

A new neutral type trichloroethylene has been added by Dow Chemical International Ltd., Midland, Michigan, US, to its industrial solvents range. The new product is designed for use in vapour degreasing operations which require a neutral rather than an alkaline type of trichloroethylene.

New Dutch Fatty Acids Plant

A plant for the manufacture of fatty acid derivatives is under construction by the Dutch company of N. V. Koninklijke Stearine Kaarsenfabriek Gouda Apollo. The present plant is said to be barely able to meet demand for these products. The company, which is celebrating its centenary this month, has spent about 17 m. florins (approx. £1,700,000) on new plant over the last ten years, supplied almost entirely from its own resources.

Figures For Sulphur Production in Italy

During the month of April this year Italian producers delivered to EZI (Sulphur Board) 13,505 tons of sulphur, of which 10,873 tons or 80 per cent were produced in Sicily. During the same month, 12,796 tons were distributed by EZI to consumers. Out of this total, 3,990 tons (30.7 per cent) went abroad (mainly to France and Yugoslavia). Existing stocks of sulphur increased from 211,754 tons as recorded on 31 March, 1958, to 212,471 tons by 1 May.

EZI has just fixed the following compulsory classification of sulphur:

Yellow real yellow, sulphur content at least 99.5 per cent; brownish, sulphur content at least 99 per cent; *Brown* Marche Romagna type at least 99.5 per cent; first quality at least 98.5 per cent; *Concentrates* minimum content (dry) 85 per cent; maximum humidity (dry types) 3 per cent, (damp types) 15 per cent.

New Method for Determination of Cobalt

A new method for the identification of cobalt is the subject of an article by Armeanu, D. Camboli and C. Iancu (*Revista de Chemie*, 4, 9, 218). The authors studied the influence of different substituents on the analytical properties of complex salts with metals. They found that β-furoineoxyme gives a brown precipitate in the presence of Co_2^+.

The reaction was carried out in a microtube, on a porcelain plate and on filter paper. The determination limit is at 0.16 γ. of Co. Sensitivity of the reaction is 10^{-5}.

Mexican Gulf Sulphur Co Forced to Close Down

The Mexican Gulf Sulphur Co. was forced to close when its sulphur reserves ran out and it was unable to acquire new deposits near its San Cristobal plant. To cover part of its $5 million debt to the US Export-Import Bank the assets of Mexican Gulf's operating subsidairy have been foreclosed and sold to Nacional Financiera SA, a Mexican Government agency, for $2.5 million.

Canadian Subsidiaries of Allied Chemical to Merge

The first step to integrate the Canadian subsidiaries of Allied Chemical Corporation, New York, has been taken with the formation of Allied Chemical Canada Ltd. President of the new company is R. W. Atkinson. With its head office in Montreal, the company will serve as a sales and development office for the present. Ultimately, the Canadian subsidiaries will be brought under its direct control.

The subsidiaries are The Barrett Co. Ltd., Brunner Mond Canada Ltd., National Aniline and Chemical Co. Ltd., the Nichols Chemical Co. Ltd., and Semet-Solvay Ltd. Products of Allied Chemical Canada include sulphuric acid, hydrofluoric and other industrial acids, soda ash, calcium chloride, aluminium sulphate CP acids and ammonia, fine chemicals and reagents, refrigerants, detergents, roofing felts, insulating board, sheathings, coke, dyes, tars, pitch and oils.

New Labelled Isooctane

The chemical C^{14}-1 labelled isooctane (2,2,4-trimethylpentane-2,4-C^{14}) synthesised by Research Specialities, Berkeley, California, is expected to find application in hydrocarbon and petroleum research on combustion (*Chem. and Eng. News*, 36, 22, 49). This labelled compound is prepared from C^{14}-labelled barium carbonate.

The synthesis takes eight steps: maximum volume handled in any one step is only 2 ml. Despite this small scale and high purity (analysis by gas chromatography shows the compound to be chemically identical with spectro grade 2,2,4-trimethylpentane) costs will be about $700 to $900 per millicurie.

Specific activity of the material made in the one production run so far completed is 2.86 millicuries per millimole. Higher specific activities can be made, it is stated.

Foster Wheeler Invest in Italian Company

Foster Wheeler Ltd., of London, have made a direct investment in Foster Wheeler Italiana S.p.A., recently floated in Milan. The new company will design various equipment and complete plants for chemical, petroleum, petrochemical, and nuclear industries. Twenty million lire is the initial investment.

New US Insect Repellent

Based on N,N-diethyl toluamide, a new repellent developed by EI du Pont de Nemours and Co., Wilmington, Delaware, is claimed to keep off mosquitoes, gnats, ticks, etc., for up to eight hours.

A New Synthesis of Ethanol from Carbon Dioxide and Hydrogen

THE reduction of carbon dioxide by hydrogen under pressure, in the presence of oxide catalysts, leads to the formation of methanol as the main product. Among the by-products are higher alcohols, including ethanol. This has led to an investigation by some Russian workers (Bashkirov and Kamzolkin, *Dok. Akad. Nauk, SSSR.*, 1958, **118**, 293), of the effect of changes in reaction conditions, with a view to obtaining ethanol as the main product.

For this purpose a large number of catalysts, with various promoters, were tried, together with changes in temperature, pressure and composition and rate of flow of the reacting gases. The types of catalyst examined were various precipitated products based on iron, cobalt and nickel and a fused iron catalyst 'of the type used in ammonia synthesis'. The promoters were alkalis and oxides such as Al_2O_3, SiO_2, MnO, etc. The precise nature of the successful catalyst system is not disclosed but it is stated that the fused iron catalyst was more stable and more selective than the precipitated material, and that alkaline promoters were the most effective. The alkali could be introduced during the fusion process or the fused product treated with aqueous alkali.

High yields of ethanol were obtained at high pressures using a recirculating system for the effluent gases together with a continuous feed of fresh gas. At 350°C and 200 ats. pressure, 75 per cent of the liquid product from a 1:3 Co_2:H_2 mixture was ethanol. One sample of fused iron catalyst retained its original activity after more than 2,500 hours use, and the composition of the total product was virtually unchanged.

Details of the full analysis of the products under different conditions are given, and there is some discussion of the chemistry of the process.

EQUIPMENT REVIEW

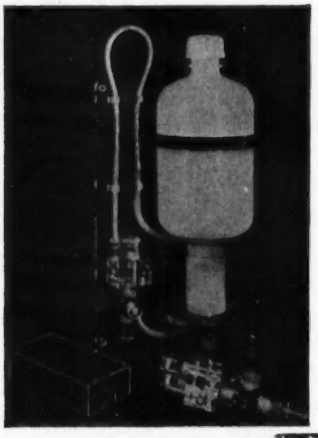
Chemical Plant: Laboratory Apparatus

Safety and Anti-Corrosion Products

PORTABLE LIQUIDS PUMP A PUMP which can be used for water, oils, etc., and also for acids and other corrosive liquids, has been developed by British Central Electrical Co. Ltd., 6 and 8 Rosebery Avenue, London EC1. The model is made with an interchangeable inner tube to allow for use with these different liquids.

Produced for a maximum motor loading of 400 w., the pump, which is a portable electric barrel type, is self-priming and will operate against full pressure. There is a thermal overcurrent cut-out in the motor-housing, which disconnects the supply until the pump cools, should overloading or overheating (beyond 60°F) occur.

AUTOMATIC DRIP REGULATOR AN automatic drip regulator to dispense all types of liquids in droplet form has been produced by R. O. Harris and Co. Ltd., Bedford Road, East Finchley, London N2,



'New drip' regulator

for Condesco Products Ltd. The bottles are polythene; the drip regulator valve is constructed in Perspex. Except for the hydraulic cylinder, its mounting brackets and a small number of screws, all units are of plastics. Metal parts are covered to protect them against corrosion.

An automatic cut-off valve, operated by a hydraulic cylinder, is interposed between the constant rate bottle and the drip regulator valve, the hydraulic cylinder being connected to the output of the final rinse pump of a bottle washer or similar supply: the minimum operating pressure being 10 lb. per sq. in. As soon as the pressure is allowed to drop, the cut-off valve operates. Regulators are supplied in 1 gallon and 5 gallon sizes. The units can be used to drip directly into tanks and vats or with a water pump for injecting directly into main flow lines.

FLUID HEAT TRANSMITTER STANDARD sizes of the direct fired fluid heat transmission unit manufactured by Beverley Chemical Engineering Co. Ltd., London Road, Horsham, Sussex, range from 100,000–1,000,000 BThU/hr. The company state that efficiencies up to 75 per cent are obtainable when running at maximum temperature (300°C) at atmospheric pressures. The Turbofin is constructed so that its fins create a high degree of turbulence, which helps to increase the heat transfer rate and reduce the possibility of fouling.

The units run continuously under automatic control. The burner supplying the heat will operate on any type of fuel, and has a turn down ratio of 5–1.

The Turbofin is designed to allow its use in flame proof areas and, not needing foundations or heavy furnace brickwork, can be transported without much difficulty.

MATERIAL GRADES OF PTFE So far eight 'grades' of solid raw material forms of polytetrafluoroethylene have been made available by Crane Packing Ltd., of Slough, Bucks. ('Grade' here refers to the different properties developed in the products by processing or use of additives.)

Two of the grades are reinforced by fibreglass, which addition is claimed to virtually eliminate cold flow, impart better heat transfer properties and improve dimensional stability. Uses suggested by the company for the two grades mentioned are: bearing surfaces, such as bushes or thrust discs; cylinders; tubes; various moulded and machined components, etc.

WHITE LIGHT CABINET A NEW white light cabinet has been designed for use with the British Drug Houses Ltd. Lovibond Nessleriser. The cabinet is more compact than the standard model, intended primarily for use with the BDH Lovibond Tintometer.

Containing a 40-w. lamp of the appropriate mains voltage, the cabinet enables tests to be conducted when natural lighting is not available. A pair of blue glass filters supplied with the cabinet and fitting into the rebates provided in the Nessleriser correct the colour of the original light to a white light which gives readings with the instrument corresponding to those obtained in north daylight.

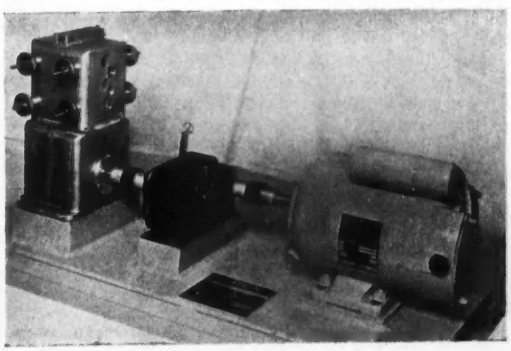
Manufacturers are the Tintometer Ltd., and sole selling agents are the BDH Laboratory Chemicals Division at Poole, Dorset.

KESTNER SULPHUR BURNER A NEW unit, developed by the Kestner Evaporator and Engineering Co. Ltd., 5 Grosvenor Gardens, London SW1, is the Kestner spray type sulphur burner. It consists of an atomiser and combustion chamber, generating the sulphur dioxide at high concentration.

It is claimed to have the following advantages: a high turn-down ratio, since the sulphur feed rate may be varied over a wide range by manipulating the feed control valve; burner gas containing up to 18 per cent SO_2 by volume may be readily obtained; the unit can be operated under any back pressure normally required for the processing of burner gas, and is of compact design.

SINUS CHEMICAL PUMP THE Apex 192 sinus chemical pump is a general pumping unit for use in research and process departments. Apex Construction Ltd., 15 Soho Square, London W1, say it will pump liquids or gases without being affected by solids in solution and without the risk of contaminating the fluids conveyed. Contamination is avoided without using expensive acid resisting materials.

The pump is self contained and operates by compressing a rubber tube carrying the liquids between a pressure plate and a



Motor-driven Apex sinus chemical pump

number of fingers which operate in a sinus movement. The pressure against the rubber tube imparts a positive unidirectional movement of the liquid. The pump's rates of flow may be varied by altering the size of the tubing used, the speed of the operating fingers, or adjusting the load placed on the pressure plate. The rates of flow obtainable in the case of the smallest model, No. 192A, are 25 gallons per hour at no head at 400 r.p.m. with a ½-in. bore tube and 2 gallons per hour at 50-ft. head at 100 r.p.m. with a ¼-in. bore tube.

These pumps can be supplied motor driven with an overall ratio of 4:1.

MELTING POINT APPARATUS

In collaboration with May and Baker Ltd., Electrothermal Engineering Ltd., 270 Neville Road, London E7, have developed a new melting point apparatus. The

Electrothermal melting point unit

apparatus is so designed that three capillary tubes are accommodated simultaneously, allowing two compounds and a mixture to be melted alongside each other.

To prevent air currents from influencing results, a borosilicate glass sleeve covers the illumination and viewing apertures and the heat transfer medium used is air. The burner, also protected by borosilicate glass, can be swung horizontally clear of the block. The low heat capacity and the block's construction enable determinations to be carried out in quick succession.

One of the main difficulties which faced the designers was that they could not find a convenient standard thermometer capable of achieving the accuracy required to determine melting points in this apparatus. A thermometer has therefore been developed by the company which, it is stated, covers the whole range of 20 °C to 360 °C. Within normal limits of laboratory ambient temperature and air currents, the calibration is accurate within plus or minus 1° over the whole 360° range at rates of heating up to 5° per minute.

Lighting is by standard miniature lamp bulbs, 6.5 volts, 0.3 amps., and the three capillary tubes, all equidistant from the thermometer bulb, are seen through a non-adjustable deep focus lens.

NEW GRINDING MEDIA

A claim that 'in practice it is found that grinding time is reduced by 30 to 45 per cent by substituting Alorite for silica pebbles or porcelain balls' in ball mills is made by W. Podmore and Sons Ltd., Shelton, Stoke-on-Trent. This grinding media, a hard abrasion resistant alumina developed by Alorite Ltd., is made in cylindrical pieces from diameters and lengths of ½ in. to 2 in.

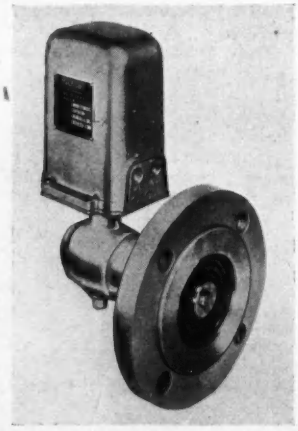
Under normal conditions Alorite is chemically inert and resistant to attack by acids and alkalis. Its properties are given as: crushing strength (20 °C), 420,000 lb. p.s.i.; transverse strength (20 °C), 35,000 lb. p.s.i.; tensile strength (20 °C), 37,000 lb. p.s.i.; Mohs hardness, 9; specific gravity, 3.65; thermal conductivity (CGS units), 0.54.

Used for both wet and dry grinding, Alorite is said to permit wet grinding to be carried out at a much higher slip viscosity than usual and, if the mill is run for a given time, to allow a finer product than possible before with other media. When Alorite is employed quicker mill wear can be expected, but once related to output it should be found that the life of the lining has actually increased.

LIQUID LEVEL TRANSMITTER

The new liquid level transmitter made by Foxboro-Yoxall Ltd., Redhill, Surrey, is designed for use with either open or closed vessels and for mounting directly in any position to the tank's side. The instrument can be obtained in a number of corrosion-resisting materials and is for service on pressures up to the rating ASA 300 at 350 °F maximum vessel temperature.

The company's new M/41A equipment can act in two capacities: as an air-operated indicating controller and recorder for pressure, temperature, relative humidity or open-tank liquid level applications; and as a pneumatic receiver for 3–15 lb. p.s.i. signals. The makers claim the M/41A has a performance for simpler applications equal to that of more costly and flexible instruments.

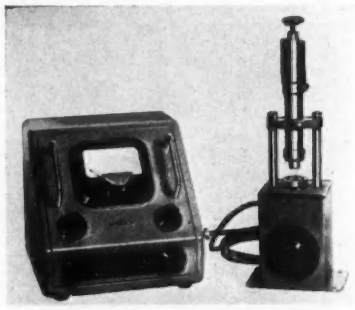


Direct mounted liquid level transmitter

Standard Foxboro components are used, mounted in a dust and moisture-proof cast aluminium case. A control unit provides on/off action to an eighth of 1 per cent of scale range. The pneumatic proportioning mechanism is adjustable from a quarter of 1 per cent to 25 per cent of the scale. Surface, flush, yoke or valve mountings are available.

SHAW MOISTURE METER

The Shaw constant pressure type moisture meter obtains its readings by passing high radio frequencies of over 100 megacycles through a sample. The moisture is indicated on a 5 in. meter dial and there are readings which the company states can be determined to one part in 1,400, from complete dryness to 100 per cent water. The dryer



Constant pressure moisture meter

the test sample the higher is the accuracy obtainable.

The meter can be used by unskilled workers and should not be affected by normal electrolyte variations. No weighing of the sample is required. Manufacturers are: Shaw Moisture Meters, 31 Market Street, Bradford, Yorks.

ELECTRONIC TEMPERATURE CONTROLLER

Recently Sifam Electrical Instrument Co. Ltd., of Leigh Court, Hr. Lincombe Road, Torquay, made generally available their Pyromaxim electronic temperature controller. The company describe the mirror scale of more than 8 in. length as ensuring legibility and accurate reading of temperatures to better than 1 per cent, and the control response as within ¼ per cent.

The measuring galvanometer employs an Alcomax magnet surrounding a moving system which swings between spring-mounted sapphires. Automatic cold junction compensation is a standard provision. A simple electronic circuit provides the link between measurement and control which instantaneously operates an enclosed relay rated at 3A and 250V AC non-inductive load. The electronic amplifier unit can be plugged in or removed quickly. The Pyromaxim is available in ranges from 0–200 °C to 0–1,600 °C or Fahrenheit equivalents, and is supplied for use with supply voltage of 110/220/240 AC. Price: £32 10s.

People in the NEWS

● Three British scientists, DR. A. J. P. MARTIN of Elstree, Herts, MR. BASIL ADAMS of Barry, Glamorgan, and MR. ERIC HOLMES of Wollaston, Northants, have received John Scott awards for 1956 in the US. Dr. Martin, who was a co-winner in 1952 of the Nobel prize in chemistry, receives his awards for his work on chromatography. Mr. Adams and Mr. Holmes share an award for their work on ion-exchange resins. The awards were established in 1816 by John Scott, a Scottish chemist, who bequeathed funds in Philadelphia for setting up trusts.

● MR. C. W. MAPLETHORPE, F.P.S., F.R.I.C, M.I.Chem.E., managing director of Allen and Hanburys Ltd., is to have conferred on him the degree of M.Sc. (honoris causa) at a ceremony at Manchester University on 4 July.

● On 8 June MR. A. S. HUMPHRYS, manager of the Australian office of Humphreys and Glasgow Ltd., will arrive for a month's visit to the firm's headquarters in Carlisle Place, London SW1. He will be studying latest trends in the gasification of oil and coal, with particular reference to pressurised hydrogenation processes, nuclear power plants and chemical process installations.

● MR. ALAN TALBOT has been appointed managing director of a new pharmaceutical company, Merrell-National (Laboratories), which is to open in the near future. This company is a branch of William S. Merrell Co. of Cincinnati, US.

● DR. R. M. ACHESON, M.A., D.PHIL., lecturer of Queen's College, Oxford, formerly of Magdalen, has been elected to an official fellowship and praelectorship in chemistry at Queen's College.

● PROFESSOR W. COCKER, of the chemistry department, Trinity College, Dublin, has been elected one of the college's eight new Fellows.

● DR. E. MAYNE REID was elected president of the Fertiliser Society at the annual meeting held on 29 May. Dr. Mayne Reid was educated at Belfast College of Technology and the Queen's University, Belfast, where he obtained his B.Sc. and Ph.D. He is also a Fellow of the Royal Institute of Chemistry. He started as works' chemist with Richardsons Chemical Manure Co. Ltd., Belfast, becoming works manager in 1935 and general manager in 1943. He is now a director of this company, together with W. and H. M. Goulding Ltd., Dublin, The Ulster Manure Co. Ltd., Londonderry, and The Phosphate Rock Agency Ltd., London. Dr. Mayne Reid is also vice-president, Belfast Chamber of Commerce, past chairman of the Belfast section of the Royal Institute of Chemistry, and past chairman of the Northern Ireland section of the Society of Chemical Industry.

Dr. Mayne Reid

At the same meeting MR. A. I. COLEMAN, of the West Norfolk Farmers' Manure and Chemical Co-operative Co. Ltd., was elected vice-president of the society.

● MR. R. H. BATES, managing director of the National Benzole Co., will retire on 30 September. MR. A. M. ROBERTSON, the company's present general manager, will succeed him. Mr. Bates became a director of National Benzole in 1946 and was appointed managing director in 1951. He became chairman in 1955, resigning from that post the following year but continuing as managing director. He remains chairman and managing director of Benzole Producers and is a director of Burt, Boulton and Haywood and of William Butler (Bristol).

Mr. Robertson joined Shell-Mex and BP, who acquired National Benzole last year, in 1954. He became general manager of National Benzole in 1957.

● DR. A. H. BECKETT, reader in pharmaceutical chemistry, Chelsea School of Pharmacy, has been invited to be a speaker at the Sixth National Medicinal Chemistry Symposium of the American Chemical Society to be held from 23 to 25 June at Madison, Wisconsin, US. His subject will be 'Stereochemical and biochemical considerations in the approach to drug design'.

● SIR ARCHIBALD F. FORBES, C.B.E., chairman of the Iron and Steel Board, has been appointed a director of Dunlop Rubber Co. Ltd.

● At a general meeting, held on 23 May, the main clauses of a constitution for the Institute of Information Scientists were approved, and the honorary officers and a council were elected as follows: president, DR. G. MALCOLM DYSON; vice-president, C. W. HANSON; hon. sec., J. FARRADANE; hon. treasurer, A. GORDON FOSTER; council members: MISS D. CALDWELL, MISS I. M. SLADE, and L. J. HAYLOR, A. H. HOLLOWAY, F. LIEBESNY, J. S. P. PATON, J. B. REED, and O. W. SNOW.

The council will proceed immediately with the consideration of applications for membership, preliminary steps towards the provision of examinations for the certificate of the Institute and the promotion of educational courses, and the arrangement of suitable meetings.

Further details can be obtained from Mr. Farradane, 'Torran', Crofton Road, Orpington, Kent.

● MR. N. L. J. MOULD, works manager of Dunlop South Africa Ltd., has been appointed works director.

● DR. R. H. DODD has been appointed managing director of Chemical Construction (Great Britain) Ltd. in succession to MR. M. S. HENDERSON. Dr. Dodd was born in the US and educated at the Massachusetts Institute of Technology and the University of Wisconsin where he received his Ph.D. in chemical engineering. For a total of 15 years he was with Shell Standard Oil Co. of New Jersey, and Gulf Oil Corporation. During the second world war he was project manager on engineering work for two large butadiene plants built as part of the synthetic rubber programme. He came to England in 1945, staying until 1950, during which time he formed the Lummus Co. Ltd. and became its first general manager.

Dr. R. H. Dodd

Upon returning to New York in 1950 he was appointed manager of the contracts department of the Lummus Co., and later manager of the development engineering department. In 1954 he took leave of absence from Lummus for 2½ years to become professor and head of the School of Chemical Engineering at Oklahoma State University. In 1957 he was appointed director of the Lummus Engineering Development Centre at Newark, New Jersey.

● MR. D. P. G. MOSELEY (D. Moseley and Sons) and MR. P. L. SHERWOOD (Wm. Warne and Co. Ltd.) have been re-elected chairman and vice-chairman respectively of the British Wrapped Rubber Hose Manufacturers' Association and not of the Federation of British Rubber and Allied Manufacturers as stated in 'People in the News', 17 May. Chairman and vice-chairmen respectively of the FBRAM are MR. JASPER FRANKENBURG, MR. H. G. W. CHICHESTER-MILES and MR. S. D. SUTTON.

Public Subscription for Liverpool Science Library

A public subscription is to be launched soon for £500,000 to provide Liverpool with one of the finest science libraries in the world. The city librarian, Dr. G. Chandler, has said it should compare with the Radcliffe Science Library at Oxford, the John Grerer Library in Chicago, and the many Russian and German State-sponsored libraries.

The library, which would take three years to complete, would be a four-storey building, and the top floor would provide conference and lecture rooms.

Commercial News

- **Laporte Group Profit Tops £2m — 100% Capitalisation**
- **A & W Vote on 'One-in-Four' Share Increase**
- **Glaxo Offer for Allen & H Now Unconditional**
- **Zinc Price Fall Reduces Consolidated Zinc's Profit**

Laporte Industries

Group income of Laporte Industries for the year ended 31 March was £2,117,658 (£1,774,443). Taxation took £1,053,763 (£849,484) and group net income was £1,047,713 (£909,177). Parent company's net income was £530,115 (£470,718). A final dividend of 11 per cent is being paid on the £4,057,371 ordinary capital, making with 5 per cent interim on the pre-rights issue capital, an unchanged total of 16 per cent.

The company proposes to capitalise £4,057,371 of reserves, for which CIC consent has been obtained, by writing up the 5s units to 10s units. The new shares will rank for 1958–59 dividend.

Albright and Wilson

At an extraordinary general meeting of Albright and Wilson Ltd. held in London on 29 May resolutions were passed to increase the issued capital of the company by the issue of one fully paid 5s ordinary share (to be converted into stock) for every four 5s ordinary stock units held by stockholders on the register on 15 May 1958. Renounceable letters of allotment have been posted to stockholders.

Before the extraordinary meeting the 66th annual general meeting was held, at which the chairman, Mr. Sydney Barratt, presented the balance sheet and accounts to shareholders. The company's trading profits were given in CHEMICAL AGE, 29 March, p. 600 and an account of Mr. Barratt's report 10 May, p. 876. This was the first time that the AGM was held in London. Previously it had been held at Oldbury, Birmingham.

Aspro-Nicholas

A Canadian company, which is being formed by Aspro-Nicholas Ltd., Slough, Bucks, in conjunction with Nicholas Proprietary of Australia, will market and distribute veterinary products in North America. At first these products will probably be supplied by the UK company, but later a factory may be built in Toronto and the number of lines dealt with may also be extended.

Expandite

Group profit for year ended 29 March was £79,389 (£74,084) after all charges. Final dividend of 10 per cent, making 15 per cent, is announced on doubled capital (20 per cent on smaller capital for 53 week period).

Wm. Butler (Bristol)

Trading profit of Wm. Butler and Co. (Bristol) in 1957 fell from £202,000 to £126,000. However, the tax-free capital payment of 3½ per cent recommended in lieu of the 6 per cent final dividend brings the total cash distribution slightly in excess of that for 1956.

This tax-free capital payment resulted from the board's decision to distribute part of the capital profit arising from the sale by National Benzole, in which Wm. Butler have an interest, of their distributive trade to Shell-Mex and BP.

Glaxo/Allen and Hanburys

Glaxo Laboratories announce that they have received over 90 per cent of acceptances from ordinary shareholders in Allen and Hanburys. All conditions having been fulfilled, the offer is now declared unconditional.

The offer of three Glaxo 10s shares for every £1 ordinary in Allen and Hanburys was extended till 5 June. In due course notice will be given to acquire any balance of the ordinary.

Reckitt and Colman

Final dividend of Reckitt and Colman Holdings has been increased by 1 per cent to 8 per cent, making 12 per cent for 1957 as against 11 per cent. Consolidated trading profits were £8,195,702 (£8,135,618). After deducting tax and employees' participation the net profit is £395,000 (£304,000). The meeting will be held on 27 June. Chairman is Mr. J. B. Upton.

Tecalemit

Interim dividend of Tecalemit is being raised from 3 to 4 per cent. The directors say this does not imply that the total for the year to 31 July will be changed.

Consolidated Zinc

Trading profit of Consolidated Zinc Corporation for 1957 was £4,461,194 (£6,250,323). The fall was due to a severe drop in prices of lead and zinc. Zinc output of Imperial Smelting Corporation was lower, but alloy deliveries were higher than in 1956; profit margins on most products were lower and, overall, profits from trading in the UK were somewhat less than in 1956.

In his annual review, Mr. L. B. Robinson, chairman, said that a start had been made with an improved method of construction of individual retorts, resulting in higher output, at the Avonmouth zinc plant of Iscor.

Production at the group's four UK sulphuric acid plants was maintained at the same level as 1956. Since the end of the year an arrangement had been concluded with two major South Wales steel companies for the treatment of spent liquors from steel-pickling operations. The necessary plant will be erected at the Swansea Vale Works for the recovery of sulphuric acid and iron oxide.

Increasing competition led to a reduction in overall deliveries of zinc sulphide pigments. To secure more economic production, the Luton zinc oxide works were closed and production concentrated at Burry Port. The 31 per cent (approximate) interest in British Titan Products gave the group a substantial interest in titanium dioxide.

Capacity of the new fluorine-based refrigerant and aerosol propellants plant is now being extended. Production and deliveries of barium chemicals were substantially up over 1956.

To widen the group's chemical interests, 75 per cent of the equity of Pure Chemicals Ltd. was acquired during the year; remainder of the equity was purchased after the year-end. Pure chemicals make stabilisers for p.v.c. and a wide range of fine chemicals.

The drastic curtailment in the production of titanium metal had obscured the future outlook for rutile; outputs of rutile and zircon at Queensland were substantially higher.

Research and development departments had examined a number of new processes and materials in 'the continued search for opportunities of widening the base of our activities'. High-grade beryllium metal had been produced in the Avonmouth pilot plant for the Atomic Energy Authority.

United Indigo and Chemical

A half yearly dividend on 5 per cent preference is being paid by United Indigo and Chemical, but not from profits currently earned.

African Explosives and Chemical

Group manufacturing and trading profits for 1957 of African Explosives and Chemical Industries were £4,005,198 (£3,741,109) after charging depreciation of £1,456,836 (£1,247,408). A final ordinary dividend of 6 per cent is being paid, making 10 per cent on £18.5 million (i.e. 12½ per cent, of which 7½ per cent is final, on £13.5 million).

For temporary financing of further capital expenditure, arrangements have been made with the two ordinary holders, De Beers Industrial and Imperial Chemical Industries (South Africa) to borrow from them on loan account. At the end of December 1957 these loans amounted to £3 million.

The company meeting will be held in Johannesburg on 27 June.

Powell Duffryn Ltd.

Dividend of 2¾ per cent, less income tax, is declared by Powell Duffryn Ltd. on the 3,600,000 4¾ per cent cumulative preference shares of 10s each for the six months ending 30 June 1958.

INCREASES OF CAPITAL

BORAX (ARGENTINA) LTD., 18 Austin Friars, London EC2. Increased by £90,000, beyond the registered capital of £10,000.

RADIATOR PRODUCTS DISTRIBUTORS LTD., Chemical engineers etc. 14 Clifford Street, London W1. Increased by £1,900 in £1 ordinary shares, beyond the registered capital of £100.

NEW COMPANIES

TEXON LTD. Cap. £1,000. Manufacturing, developing, supplying and applying materials for the protection of metal, concrete, wood against corrosion and

chemical action, etc. Secretary: A. R. Tee. Reg. office: Second Avenue, Millbrook Trading Estate, Southampton.

ELECTRO-CHEMICAL INDUSTRIES LTD. Private company. Registered in Dublin on 1 April. Cap. £100,000 in £1 shares. Objects: To carry on the business of manufacturers, exporters, importers and distributors of electro-chemical, chemical and pharmaceutical products, etc.

FLORAGEN AGRICULTURAL PRODUCTS LTD. Private company. Cap. £100 in £1 shares. Manufacturers of and dealers in all kinds of fertilisers, fungicides, etc. Reg. office: 245 Oxford Street W1.

MCNEIL LABORATORIES LTD. Capital £50,000. Manufacturers, importers and exporters of and dealers in all kinds of pharmaceuticals, ethical or otherwise, chemicals, medicines and medical preparations and drugs, etc. Solicitors: Slaughter and May, 18 Austin Friars, London EC2.

POROSAN (DIY) LTD. Capital £100. Objects: To enter into an agreement with Porosan Ltd. and Walter H. Engel, to acquire any interests in patents, brevets d'invention and the like, and to carry on the business of general traders and merchants. The directors are: W. H. Engel, H. J. Wells, directors of Porosan Plastics, Ltd. Reg. office: 103 Cannon Street, London EC4.

LONDON GAZETTE
Voluntary Winding-Up

CONHILL PLANT EQUIPMENT LTD., designers and manufacturers of plant to the chemical and allied trades. William Humphrey Thomas, 3 Fenwick Street, Liverpool 2, has been appointed liquidator.

TRADE NOTES

Change of Address

In July, Chemical Construction (Great Britain) Ltd. will move to new premises at Henrietta House, Henrietta Place, London W1 (Tel. Langham 6571).

The British Chemical and Dyestuffs Traders' Association has moved to 12b Westminster Palace Gardens, Victoria Street, London SW1. The telephone number is Abbey 5292.

Heat Exchanger Agreements

An agreement has been signed between A. F. Craig and Co. Ltd., Caledonia Engineering Works, Paisley, and Hudson Engineering Corporation, Fairview Station, Houston, Texas, US, under which A. F. Craig become sole manufacturers under licence in the UK of the range of Hudson air-cooled heat exchangers.

Jeltek Ltd. Formed

A new company, Jeltek Ltd., has been set up by J. E. Lesser and Sons Ltd., Green Lane, Hounslow, Middlesex to manufacture and market the Jeltek range of protective clothing. The changeover will take effect from 1 August.

Changes of Name

S. and Co. (Chemicals) Ltd., rubber manufacturers, etc., of Downham Mills, Tottenham, London N17, have changed their name to Sherman Chemicals Ltd.

Britiona Chemicals Ltd., 27 Martin Lane, Cannon Street, London EC4, have changed their name to Britiona Ltd.

M. E. K. Chemicals (Purchasers) Ltd., Imperial Way, Balmoral Road, Watford, Herts. Name changed to MEK Chemicals (Watford) Ltd.

M. E. K. Chemicals (Watford) Ltd., 22/4 Ely Place, London EC1. Name changed to Dorharda Ltd. on March 14 1958.

Pettingill Products Ltd., pharmaceutical product manufacturers etc. Petpro Works, Kelvin Way, Crawley, Sussex. Name changed to Petpro Ltd.

Wilsons Chemical Products Ltd., 205 Hook Road, Chessington, Surrey. Name changed to Wilsons Developments Ltd.

Pure Silicon by STC

Hyperpure silicon is being produced from silane gas by Standard Telephone and Cables at their Harlow, Essex, plant. The original technique was developed by Standard Telecommunication Laboratories.

International Telephone and Telegraph, with whom Standard Telephones and Cables are associated, have signed a licence agreement with du Pont of the US for the latter to manufacture and sell pure silicon in the US and Canada.

Deletions from KID

The Board of Trade will be considering the deletion, after 19 August this year, from the lists of articles exempt from Key Industry Duty those which are no longer being imported. Consideration for exemption can be given only to articles about which specific requests are received.

Lists of the articles concerned (mostly chemicals) may be found in the Board of Trade Journal for 14 February and 9 May 1958. Applications for exemption, etc., should be sent to the Tariff Division, Horse Guards Avenue, London SW1, not later than 20 June.

Bayer AG Form Levmedic

A pharmaceutical sales associate company, to be known as Levmedic, has been formed in the UK by Farbenfabriken Bayer AG, Leverkusen, West Germany.

Directors of the new company are Mr. V. Cavendish-Bentinck (chairman), Mr. H. A. Siepmann, Mr. H. Wilmes and Dr. W. Molfenter.

£3m. Developments at ICI Cassel Works

THE CASSEL WORKS of the ICI general chemicals division, Billingham, are to be further developed at a cost of £3 million. This was stated by Mr. G. K. Hampshire, division chairman, when he presented long-service awards to employees at Billingham on 30 May.

ICI had already spent £8,500,000 since the war on developments at the Cassel works but, in spite of the slight effect on output of the US recession, were reasonably confident about the future of the plant, which was part of a particularly busy division.

Market Reports

Little Forward Trade in Industrial Chemicals

LONDON New home business on the industrial chemicals market continues to be limited to spot or nearby requirements and, although the movement to the chief industrial outlets has experienced the customary holiday interruption, contract delivery specifications have been satisfactory. There has been a reasonably good demand for the agricultural chemicals, and raw materials for the plastics industry have been in good request. Overseas demand continues at a good level. Prices remain steady with no major alterations to record. Unchanged conditions have been reported from the coal-tar products market, with creosote oil, cresylic acid and phenol in steady call on both home and export account; there has been a fair call for the light distillates.

MANCHESTER Deliveries of the alkalis and most other heavy chemical products to Lancashire consumers have been resumed this week on much the same scale as before the holiday break, but fresh bookings have been on the quiet side so far and tend increasingly to be confined to nearer delivery periods than has been experienced recently. The movement on shipping account is keeping up reasonably well. Prices generally are on a steady basis, with little change on balance to report. Except for one or two sections, business in fertilisers is at a seasonally low level. There is a fair demand for most of the leading tar products.

GLASGOW With comparatively few exceptions the volume of business on the Scottish heavy chemical market showed little change from last week. Demands have been steady, mostly against nominal current requirements, and involved more or less normal quantities. There is still, however, a tendency towards a recession of trade in some sections of industry. Prices have shown little change. mostly remaining on a firm basis. Seasonal requirements keep agricultural chemicals fairly active, while the export market continues satisfactory.

British Chrome Change Name

AT AN extraordinary general meeting of British Chrome and Chemicals (Holdings) Ltd. held on Thursday May 29 the name of the company was changed to Associated Chemical Companies Ltd. (see CHEMICAL AGE, 10 May, p. 888).

DIARY DATES

TUESDAY 10 JUNE

SCI Agriculture Group—Levington Research Station, Fisons Ltd., Levington, Ipswich. Annual summer meeting.

SCI Chemical Engineering Group—London: 14 Belgrave Square SW1. 6 p.m. 'Glass as a material of construction in the chemical industry' by J. Mc. N. Bruce.

THURSDAY 12 JUNE

SCI Microbiology Group—Visit to Brewing Industry Research Foundation, Nutfield, Redhill, Surrey. 1.28 p.m. train from Victoria.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 2 July

Magnetisable iron oxides. Electrical & Musical Industries, Ltd. **797 586**

Polymers of ethylene. Imperial Chemical Industries, Ltd. **797 344**

Manufacture of compositions containing polyethylene terephthalate and a solvent or swelling agent therefor. Farbwerke Hoechst AG. **797 425**

Production of substituted 1, 1, 2-triphenylethylenes. Merrell Co., W. S. **797 345**

Polymer compositions. British Rubber Producers' Research Association. **797 346**

Cooling towers and like structures. Zinn, W. V. **797 413 797 414**

Production of artificial resins from compounds containing oxacyclobutane rings. Henkel & Cie Ges. **797 276**

4:4¹-diaminostilbenedisulphonic acid derivatives, manufacture and use. Ciba Ltd. **797 427**

Manufacture of terephthalic acid. Imperial Chemical Industries, Ltd. **797 349**

Plant for carrying out fusion electrolysis. Vereinigte Aluminium-Werke AG. **797 428**

Naphthylamino-hydroxynapthalene - disulphonic acid and process for making it. Ciba Ltd. **797 353**

Ultrasonic apparatus for treating liquids as well as articles or substances in liquid. Bendix Aviation Corp. **797 417**

Measurement of oxygen dissolved in liquids. Tinsley (Industrial Instruments) Ltd. **797 524**

Treatment of glyceryl esters. Ethyl Corp. **797 357**

Water sterilising. Tilburg., J. Van. **797 525**

Proteinaceous preparations. Badische Anilin- & Soda-Fabrik AG. **797 526**

Oxidation of organic compounds. California Research Corp. **797 280**

Refining or beneficiation of the isomers of benzene hexachloride. Imperial Chemical Industries, Ltd. **797 431**

Modified polysiloxanes. Union Carbide Corp. **797 598**

Production of resins capable of use as tanning agents. Boehme Fettchemie Ges. **797 536**

Corrosion preventive and lubricating compositions. British Petroleum Co., Ltd., Pethrick, S. R., and Godsave, L. A. **797 602**

Basic esters of thiophosphonic acids and salts thereof. Imperial Chemical Industries, Ltd. **797 603**

Lubricants. Huet, A. **797 365**

Glyoxylamide derivatives. Imperial Chemical Industries, Ltd. **797 604**

Preparation of cation-exchange resins. Permutit Co., Ltd. **797 438**

Purification process. Imperial Chemical Industries, Ltd. **797 369**

Hydrocarbon rubber-vinyl containing organopolysiloxane compositions. General Electric Co. **797 606**

Leaching of non-ferrous metals from ores containing metalloids. Chemical Construction Corp. **797 607**

Alkaline earth metal silicates. Columbia-Southern Chemical Corp. **797 543**

Aromatic polyester solutions and shaped articles therefrom. Imperial Chemical Industries, Ltd. **797 294**

Therapeutically valuable cysteine compounds. Recherches et Propagande Scientifiques. **797 507**

Electrodeposition of polymeric material from aqueous dispersions thereof. Du Pont de Nemours & Co., E. I. **797 551**

Silicon containing pigment. Columbian Carbon Co. **797 374**

Lubrication. Imperial Chemical Industries, Ltd. **797 291**

Device for dispensing lumpy, granular or powdery materials. Hoekstra, J. S., and Verschure, H. J. M. **797 609**

Preparation of ketoximes. Wilson, C. L. **797 611**

Flexible cellular products from polymeric materials, polyisocyanates and water. Goodyear Tire & Rubber Co. **797 299**

Neutral thiono-thiol-phosphoric acid esters. Farbenfabriken Bayer AG. **797 307**

Containers for radio-active materials. Power-Gas Corp. **797 309**

Anthraquinone dyestuffs. Imperial Chemical Industries, Ltd. **797 383**

Production of titanium metal and titanium alloys. Eltro Ges. & Co., Für Stahlungs-Technik. **797 616**

Manufacture of polymers. British Nylon Spinners, Ltd. **797 617**

Lubrication. Esso Research & Engineering Co. **797 560**

Extraction and purification of sapogenins. Glaxo Laboratories, Ltd. **797 384**

Device for atomising liquids. Mocquard, J. **797 315**

Production of polymeric functional derivatives of acrolein. Deutsche Gold- und Silber Scheideanstalt Vorm. Roessler. **797 459**

Organosilicon resin compositions. Midland Silicones, Ltd. **797 318**

Activating cathode surfaces of electrolytic hydrogen generators. Lonza Electric & Chemical Works, Ltd. **797 565**

Hardening of gelatin compositions. Kodak, Ltd. **797 321**

Treatment of solutions comprising similarly charged monovalent and polyvalent ions to concentrate the polyvalent ions. Dow Chemical Co. **797 624**

Manufacture of adipic acid. Goodyear Tire & Rubber Co. **797 464**

Antibiotic paromomycin. Parke, Davis & Co. **797 568**

Petroleum resins from solvent extracted fractions. Esso Research & Engineering Co. **797 386**

Ester having an antispasmodic and anaesthetic effect. Aktiebolaget Bofors. **791 627**

10-dialkylaminoalkylphenothiazine - 9 - oxide derivatives. Yoshitomi Pharmaceutical Industries, Ltd. **797 628**

2-amino-5-mercapto-1, 3, 4-thiadiazoles. American Cyanamid Co. **797 469**

Electrolytic method for recovering metallic gallium. Soc. Anon. pour l'Industrie de l'Aluminium. **797 501**

Electrolytic process for purifying a solution of alkali aluminate with simultaneous recovery of metallic gallium and vanadium compounds. Soc Anon. pour l'Industrie de l'Aluminium. **797 502**

Trichloromethylthiosulphonate compounds. American Cyanamid Co. **797 309**

Gas filters of the oil bath type. Triggs, W. W. (Air-Maze Corp.) **797 572**

Aluminate glass. Zeiss-Stiftung, C. [trading as Jenaer Glaswerk Schott & Gen]. **797 573**

Therapeutically active amino-ethers. Naamlooze Vennootschap Koninklijke Pharmaceutische Fabrieken Vorheen Brocades-streeman & Pharmacia. **797 473**

Producing citric acid by aerobic fermentation of solutions containing molasses. Usines de Melle. **797 350**

Organotitanium compounds. National Lead Co. **797 351**

Phosphoric esters. Olin Mathieson Chemical Corporation. **797 352**

Sulphonylurea derivatives. Boehringer & Soehne Ges., C. F. **797 474**

Manufacture of carotenoids. Hoffmann-La Roche & Co., AG., F. **797 635**

An aromatic carboxylic acid. Olin Mathieson Chemical Corp. **797 475**

Method and apparatus for hydrating dolomitic quicklimes. Saun Mfg. & Eng. Corp., K. Van. **797 328**

Method and apparatus for heating fluids. Oxy-Catalyst, Inc. **797 574**

Desulphurising petroleum hydrocarbons. Esso Research & Engineering Co. **797 637**

Amides of trialkoxybenzoic acids. Bristol Laboratories, Inc. **797 476**

Preparing basic alkaline earth metal alkylaryl sulphonate. Continental Oil Co. **797 409**

Electrolytic cells. Columbia-Southern Chemical Corp. **797 482**

Polyurethane foams. Farbenfabriken Bayer AG. **797 576**

Flaky powders. Polvos Metalicos Soc. Anon. **797 577**

Cracking of oligomers of isobutene. Badische Anilin- & Soda-Fabrik AG. **797 578**

Catalytic hydrogenation of nitrosamines. Hercules Powder Co. **797 483**

Process and apparatus for the production of combustible gas. Soc. de Construction d'Appariels pour Gas à l'Eau et Gas Industriels. **797 334**

Liquid suspension of magnetic particles for inspection methods. General Electric Co. **797 335**

Utilisation of mixtures of organic and inorganic acids in the preparation of greases. Esso Research & Engineering Co. **797 486**

Methods and devices for preparing a mixture for lead-containing glasses. Naamlooze Vennootschap Philips' Gloeilampenfabrieken. **797 337**

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